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DEVOTED TO THE INTERESTS OF TEXTILE CHEMISTRY
BLEACHING ◆ DYEING ◆ FINISHING ◆ PRINTING

VOLUME 27 | AUGUST 8, 1938 | NUMBER 16

New

A Pink for Acetate Rayon

Geigy has ready for issue
Color Chart 967 illustrating

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from the description of which you are sure to be interested in giving it a fair trial on lustrous or delustered Acetate Rayon. That trial should show it to disperse readily, to dye level with interesting "pile-up" qualities besides giving generally good processing and consumer fastness.

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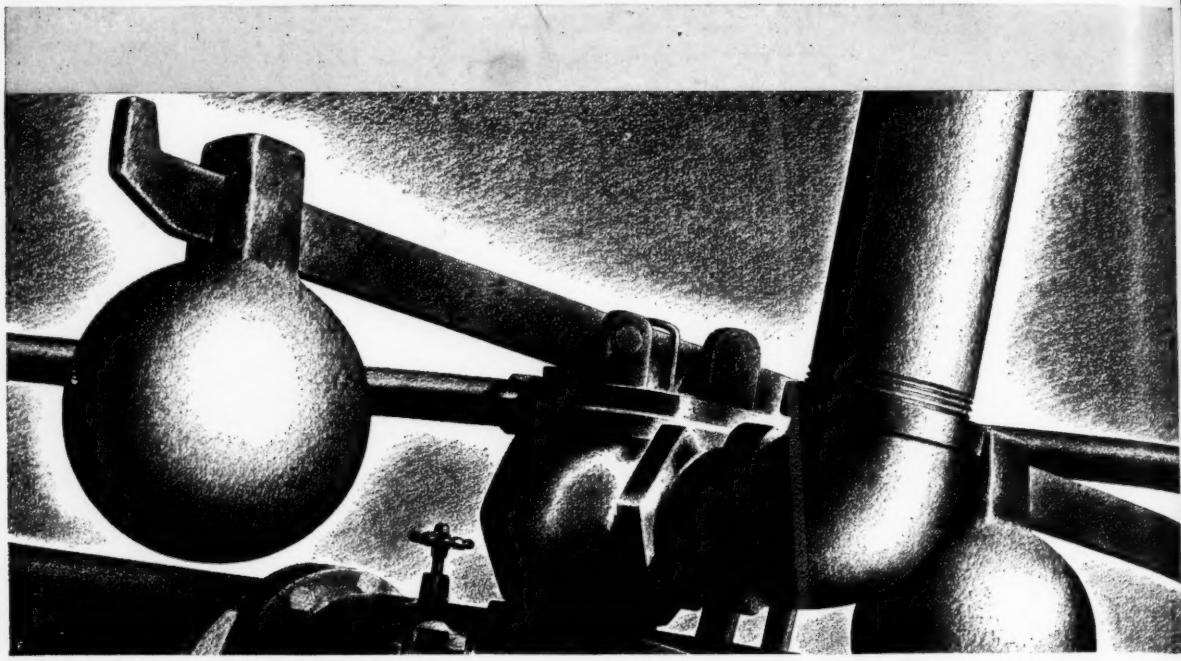

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THE OBJECTS OF THIS ASSOCIATION ARE:

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"To encourage in any practicable way research work on chemical processes and materials of importance to the Textile Industry.
"To establish for the members channels by which the interchange of professional knowledge among them may be increased."

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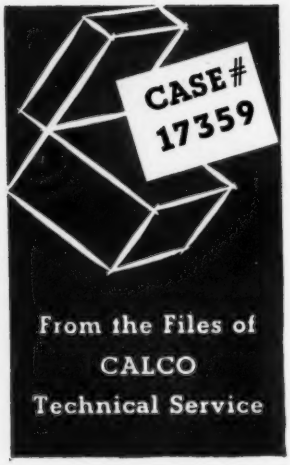

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AMERICAN
DYESTUFF REPORTER
VOLUME 27 AUGUST 8, 1938 NUMBER 16

The Processing of

Rayon and Acetate Rayon Fabrics

C. B. ORDWAY, M.S.

Part 1–The Preparation of Rayon and Acetate Rayon Greige Goods and the Crepeing Process

ECONOMY of time, ware-housing and shipping space, on our transportation systems have all contributed to the modern trend of efficiency in manufacturing and merchandising of textiles. This trend of economy leads to many changes and necessary precautions in the wet processing and finishing of textile fabrics.

In the last few years, the rayon weaving plants have started baling their woven acetate and rayon greige goods to be shipped to the converter or finishing plant.

The current types and constructions of acetate and viscose rayon fabrics might be listed as follows:*

Flat Crepe: 96 x 64, 150 denier acetate warp and 100 denier viscose crepe filling, 55 turns S and Z twist, *2 x 2* picking, usually 44″ in reed and 38-39 finished; plain weave.

Krinkle Crepe: 92 x 48, 150 denier dull acetate warp and 150 denier viscose crepe filling, 50 turns S and Z twist, *4 x 4* picking; 48-49″ in reed and 38-39 finished; plain weave.

Crepons: 112 x 64, 120 denier dull acetate warp and 100 denier viscose filling, 55 turns S and Z twist, *1 x 1* picking; usually 49-50″ in reed and 38½-39″ finished; plain weave.

Gamza Crepe: 96 x 52, 150 denier dull acetate warp and 200 denier viscose filling, 48 turns S and Z twist, *2 x 2* picking, usually 47-48″ in reed and 38 to 39 finished; plain and fancy weaves.

Canton Crepe: 112 x 64, 120 denier dull acetate warp and 100 denier viscose crepe filling, 55 turns S and Z twist, *2 x 2* picking, 45-46″ in reed and 38-39 finished; plain weave.

Friendship Crepe: 135 x 52, 100 denier dull acetate warp and 200 denier viscose filling, 49 turns S and Z twist, *2 x 2* picking, 48-49″ in reed and 38-39″ finished; plain weaves such as the failles.

Romaine Crepe: 52 x 48, 100 denier viscose crepe warp with 150 denier acetate warp twisted 12 turns S or Z twist and 75 denier viscose crepe with 100 denier dull acetate filling twisted 14 turns S or Z twist, as filling; *1 x 1* picking; usually 48-49″ in reed and 38½-39″ finished; plain weaves.

Alpaca: 40 x 36, 100 denier dull acetate and 100 denier viscose crepe twisted 10 turns and twisted with another yarn for same make-up and the two twisted with 5 turns S twist for warp and the same for filling, *1 x 1* picking, 49-50″ in reed and 39″ finished. (Many variations of this type of fabric, chiefly plain weaves.)

The all-rayon fabrics are mainly of above constructions with variations as individual manufacturers bring out for novelty purposes.

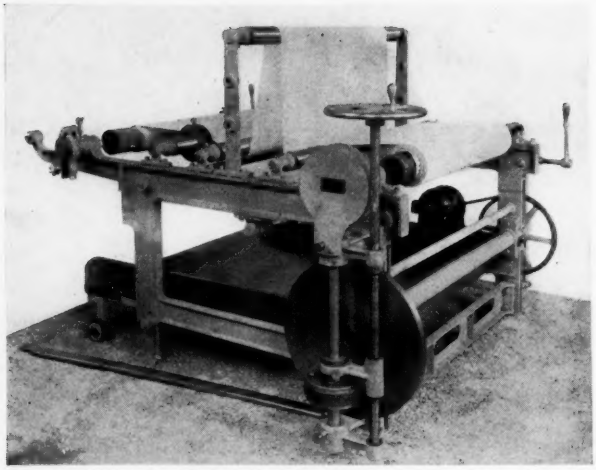
Every rayon and acetate piece-goods dyer and finisher remembers there was always plenty of trouble when the greige goods were received in the beam form but now the baled goods present additional worries such as the folds formed in the baling of goods especially if the goods have been in storage an indefinite period.

A careful study of the handling of baled goods preparatory to the crepeing bath is of vital importance to every dyeing and finishing plant official. There are different layouts of equipment suitable for the proper handling of the beaming and sewing of the piece-goods in preparation for the engraving and crepeing processes.

The simplest and one of the most economical layouts as to time required for operation would consist of a beamer using a variable speed drive for careful regulation of speed, the beamer to be equipped with a high speed overseam sewing machine on railway and necessary measuring devices. It is of value to have a flat seam as will be shown later in this article. When using this layout or any similar one, certain special precautions will prove useful in instructing learners and assisting overseers in checking the operatives as to the quality of their work.

The baled acetate-rayon goods are usually received in bales of 25 pieces and the beams are made up into standard beams of five pieces.

*Rayon and Synthetic Yarn Handbook, 2nd Edition—Chapter IX—Dr. E. W. K. Schwarz and H. R. Mauersberger.



Photo, Courtesy, Van Vlaanderen Machine Co.

Fig. 1—One of the latest types of beaming machines.

DO'S AND DONT'S FOR THE BEAMING OPERATION

1—Check the beam ticket with shipping ticket and number on burlap bale.

2—Inspect bale for water, oil, or other type marking. Make report if present.

3—Lay bale on flat side with bucklets of steel ties facing up.

4—Open bale carefully by sniping at buckle of steel tie without cutting burlap bale or goods.

5—Cut bale stitches at each end of bale and fold the burlap bagging and wrapping paper down carefully. This leaves the pieces of greige goods properly open for handling.

6—Check bale number on first piece to see that it corresponds with number on outside of burlap bagging as well as order number.

7—Inspect condition of goods. Report TEARS and STAINS seen at this point by recording on ticket, also "flag" these places at the selvedge with vat or naphthol dyed yarn for later identification.

8—Remove first piece from bale without unnecessary rumpling. Place carefully in box beneath the beamer which should be aligned square with machine and all folds laying flat so that goods will run off freely.

9—Lay top end of piece over front rail and stretch on pins of sewing machine. Filling must be straight.

10—Lay end-cloth on top of piece end now stretched on sewing machine. Keep filling of end-cloth as straight as that of piece-goods.

11—The tension between the pins must be moderately tight but not too tight.

12—Start sewing machine and hold the two ends of goods together ahead of the sewing machine as it travels across the railway. This will insure a straight seam. Inspect seam, if not right, sew it again until satisfactory.

13—Remove seam from pins of sewing machine and thread end-cloth through beamer. Wind end-cloths evenly and tightly on shell.

Be certain that the end cloth is free of wrinkles or they may show later in goods.

14—Now start beamer and run slow enough so that careful inspection of goods for holes and stains can be made, but fast enough to give a good firm roll with even edges and without creases.

15—Report all defects noted, place initial by notation on order and beam ticket. Failure to report all defects even when they disappear in the processing will lead to carelessness in recording major defects. Always be certain of your records so that fuller verbal explanation can be made to officials later, if necessary.

16—Watch for end of piece and stop machine so as to keep smooth beam. Place end of piece on pins.

17—Remove second piece from bale and check piece number to see that it is similar to first end. Place piece No. 2 in box of the beamer in the same manner as directed on piece No. 1.

18—Sew ends of piece No. 2 to end of piece No. 1 and repeat these operations until all pieces listed on order are promptly beamed.

The use of colored sewing thread (naphthol or vat dyed) enables the embossing operative to watch for seam to better advantage. This also shows the bundling operative on the crepeing baths that he is tearing a seam between different pieces of creped pieces and not in the middle of a piece that was sewed together probably in the weaving plant.

Always check yardage of each piece as it passes over measuring roller, make notation on ticket and if there are differences in measurement call to attention of proper official.

Try to keep right hand edge of goods running against wooden guide.

A correctly beamed piece of goods should be smooth and have no unevenness on ends.

Lift the finished beam off the beamer with the bar in the shell.

PLACE GENTLY on truck—NEVER THROW ON TO TRUCK.

BEAMS MUST NEVER BE HANDLED CARELESSLY. TIME IS WASTED BY ROUGH HANDLING OF EXPENSIVE GOODS LIKE THESE because ROUGH HANDLING CAUSES WRINKLES, TORN PLACES, and other damage too numerous to list.

The goods are now ready for the embossing calender or embosser if they are of construction requiring the embossing operation.

THE ENGRAVING OR EMBOSSING OF ACETATE CREPES AND RAYON CREPES

The processing of acetate and rayon crepes when first introduced was carried out without embossing a design on the greige goods preparatory to entering the boil-off (crepeing) bath. The finishing plants followed the older silk processing methods and as a result they obtained finished crepes that had "break" marks and uneven crepeing effect.

To overcome this defect of uneven crepeing, one of the French finishing plants conceived the idea of photographing fine and coarse silk finished silk crepes and transferring this design by engraving the same on a cylinder. Thus the two standard types of engraved designs for embossing calenders were originated. The fine and coarse designs are known as numbers 2 and 4 respectively.

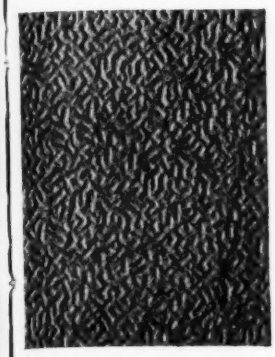


Fig. 2—Number 2 pattern.

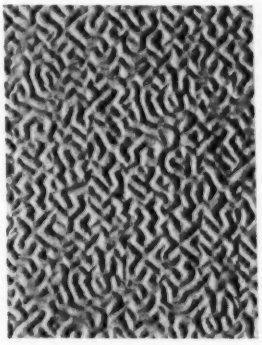


Fig. 3—Number 4 pattern.

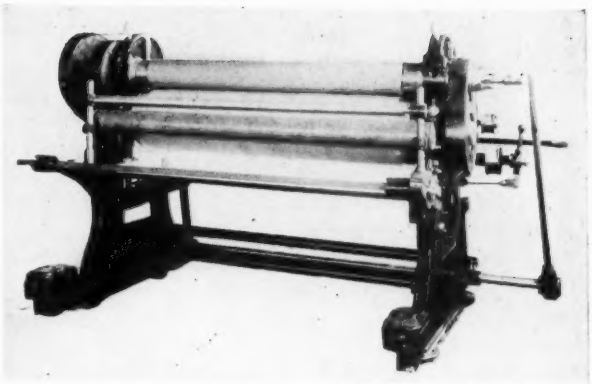
This engraving or embossing of the greige goods helps to equalize or even up the pebble (crepe) before it enters the hot boil-off (crepeing) bath.

The embossing of the goods is carried out by steaming the goods as they pass between engraved rolls under pressure and heat applied by the top cylinder. There is formed a permanent design for the acetate warp and this aids in setting the high twist rayon filling to the required pebble. This operation helps to correct the variations found in the high twisted filling yarns and differences in tension occurring during weaving operation by setting of the yarns in their proper position in fabric so the goods may be carried through the crepeing, dyeing, drying, and finishing operations to the best advantage.

The standard type of embossing calender consists of a top steel roll with engraved design thereon and the bottom roll is composed of a felt paper composition on a steel center. The top roll has a hollow center whereby the engraved surface may be heated by steam pressure of 40 to 50 pounds as desired. This gives temperatures on the top roll of 250-270° F. according to surface pyrometer readings, and these are considered suitable temperatures for the embossing of both acetate and viscose crepes since the goods are only exposed to this temperature for such a short period.

The embossing of goods on cold cylinders has been "rumored" but it is not considered standard practice as there is too great danger of cutting the fibers of the viscose and acetate yarns.

The top roll is geared directly to the bottom roll by gears which intermesh at all times. This is necessary as the top steel roll bearing the engraved design is impressed onto the lower paper composition roll and thus we have an intermeshing of designs that must be kept intact



Photo, Courtesy, King & Gerber

Fig. 4—Two roll embossing calender.

through all operations. Great care must be exercised in the operation of the embosser so as to prevent damage to the goods in process as well as to the impressed design on lower roll and engraved one on top roll. The perfect co-ordination and adjustment of the pressure (from cylinders), steam and moisture (from copper steamer located in front of embossing cylinders), and heat (from top cylinder) is necessary for satisfactory engraving of the greige goods.

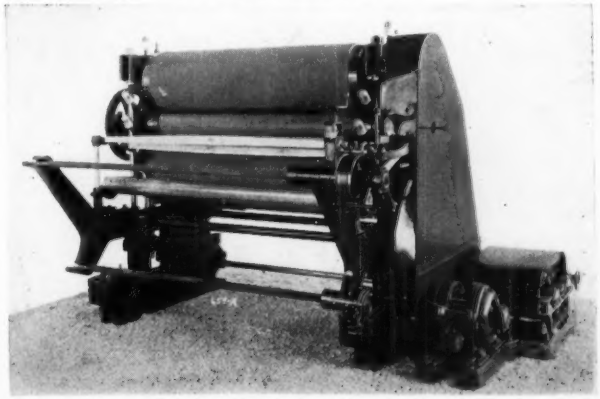
The following precautions on the operation of the embossing calender will help to insure properly embossed greige goods without cutting of the design by engraved surface or injury to the fibers within the fabric:

1—The beamed goods must be free from wrinkles, bias effect, and turned selvedges. If wrinkles are present it is advisable to run the goods on a short tenter frame so as to remove them and the bias effect. The operative must prevent turned selvedges going through the engraving rolls.

2—There should be just sufficient tension placed on goods entering the engraving rolls to prevent wrinkles and turned selvedges. Sufficient tension is obtained usually by permitting the beam to unwind naturally without using any tension from the friction brake. Whenever there is any undue "pull" on goods entering or leaving the rolls this may cause cutting of the impressed design on fabric

Fig. 5—Three roll embossing calender.

Photo, Courtesy, Van Vlaanderen Machine Co.



causing lowered tensile strength, and injuries to the surface of the finished fabric.

It is very advantageous to have a rayon fabric tensile testing machine to keep tests on samples of goods before and after engraving. This is the surest manner to detect trouble of this type and tests should be run hourly during the operation of the embossing machines.

3—The tension of the engraved goods leaving the rolls can be regulated by the size of beam. It is best to have the goods leaving rolls with a slight slackness thus preventing any possibility "pulling" of the engraved goods and causing cutting of the design just discussed. The beam of engraved goods should have a degree of softness but never so soft as to give a flat appearance when placed on a truck.

4—The preventing of water spots on goods entering the engraving rolls is very important as these show up on finished goods to a marked degree. This causes a partial waterproofing of some sizing materials. This trouble can be prevented by attention to these points:

a—Careful operation of the steamer.

b—Installation of a steam pipe just beneath the spiral straightening rods and the covering of this steam pipe with cloth. (This steam line will keep the rods warm and prevent condensation forming on cold rods and dropping on the greige goods entering rolls.)

c—The building of a larger housing over the steamer so as to enclose outgoing steam and focus it onto the greige goods entering the rolls.

5—The sewing of the seams on the beamed goods with usual raised types of seams requires the embosser operative to raise and lower the tension bar every time that a seam passes through the rolls so as to prevent injury to the engraved surfaces. An operative can become rather careless in the operation of the tension bar and in doing so it will result in waste either of cloth or injury to engraving.

This waste can be overcome by careful sewing of the seams on the beamer with a flat seam using specially selected sewing thread. The use of this type of seam results in producing engraved greige goods from one end of the beam to the other without the raising or lowering of the tension bar, or any injury to the surface of engraved rolls.

The greige goods now properly beamed and engraved are ready for the crepeing bath.

CREPES

Crepeing of Acetate-Rayon and Methods Used

The greige goods may be sized with one or more of the following materials:

1—Gelatine—Edible and non-edible types.

2—Casein.

3—Synthetic resins—Water soluble, and partially soluble types.

4—Starches.

5—Vegetable gums.

6—Dextrines.

7—Oils and softeners—Animal, vegetable, mineral.

The purpose of the crepeing operation is to remove these sizing materials as completely as possible without any injury to the fabric and "setting" the pebble or crepe for the desired effect that must be obtained on the finished fabric. By desired effect is meant the general appearance, correct feel, and proper condition for dyeing and finishing operations that are to follow.

The crepeing operation is the first wet process that the greige goods encounter and in the following processes the goods can be correctly called crepes.

In the crepeing of acetate-rayon greige goods, we have two distinct operations,—three if you wish to list the steeping or desizing operations where enzymes are used on goods obtaining starch or other sizing materials that are difficult to remove without first solubilizing.

These two chief operations are called the "boil-off" and the washing or scouring baths.

The term "boil-off" is rather a misnomer. It is a carry-over from the terminology of the silk processing operatives who have largely manned the rayon processing field.

Boil-off in the processing of silk means definitely the degumming or removal of the gum from silk goods while with rayon fabrics it might be defined as the first operation in the crepeing of the greige goods.

The boil-off bath is to wet out the greige goods whereby an even crepe effect is produced, leaving the goods in suitable condition for entering the scouring bath which must then remove all the sizing and other foreign matter that remains. The actual crepeing action of the greige goods continues through both of these processes, as a rule. The exception to this rule is low count goods where due to necessity of low costs the goods are creped and scoured in one bath. This is carried out on the winch and some plants use this bath for the dyeing operation as well; a practice not to be recommended. The dyeing operation usually follows the scouring in standard procedure.

The object of the boil-off bath is many-fold and has many pitfalls. These objectives are:

1—Instant and uniform wetting-out of the greige goods.

2—Lubricants and softeners in the warp size should be of the type that become instantly soft and partially soluble on the initial wetting-out of the greige goods. This enables the highly twisted filling yarns to shrink and move evenly through the well lubricated warp yarns though they may still retain their size.

3—The ingredients used on the filling yarns must be instantly soluble and act as lubricant also in this shrinkage process that takes place and gives the crepe or pebble effect to the finished goods.

4—The warp size materials must be removed entirely in the scouring bath as they are chiefly softened and solubilized in the boil-off.

When ever the scouring or washing operation does not remove these materials then it is necessary to give another scour preliminary to the dyeing operation.

The object of the scouring or washing operation is to continue to solubilize and emulsify all sizing material, grease, dirt, tinting agents. and foreign matter. Through this action the goods can be cleaned and left in a similar condition to the yarns that went into the weaving of the goods. This is essential for satisfactory dyeing and bleaching operations.

The make-up of the boil-off bath is determined by the type of greige goods to be processed and the warp sizing materials on goods.

1—Starches must be given preliminary desizing treatment with enzymes to solubilize the starch.

The goods on entering the older type of continuous layouts were poled by an operative who worked on a raised platform by the side of the boil-off bath without tangling and in open-width so that they entered the scouring and washing operation in satisfactory condition. But not all operatives exercised the same skill and could obtain uniformly processed goods from day to day.

2—Low quality gelatine (glue) or casein may require a preliminary treatment with an enzyme of the protease type though there are other satisfactory agents for this purpose besides enzymes.

3—Greige goods containing dextrine are only soaked or steeped in water as preliminary treatment. Due to the solubility of the dextrines, this process is usually omitted and the greige goods are entered directly into the boil-off bath.

4—Synthetic resins used in warp sizing are sometimes a source of trouble when the warp sizing maker or the weaving plant adds formaldehyde or any similar acting agent to the size mix.

This addition is usually made to improve the pebble on the greige goods but may cause a partially insoluble condition to set up on the sized warp yarns when they are dried on the hot drying cylinders of the slasher. If gelatine or casein is also present in the size, this insoluble condition will be increased. Such a condition as this will tend to give uneven crepeing (shrinkage) and resist spots that will show up as blotchy marking on the dyed goods.

5—On oils, some authorities claim that the sulfonated vegetable oils have a tendency to form insoluble or partially insoluble resins due to the high heat of the sizing and embossing cylinders plus the oxidizing action of long storage. The mineral oils are troublesome but require no preliminary treatment before entering the boil-off. Preknowledge of their presence in the greige goods is invaluable for thereby the boil-off bath may be specially fortified with those compounds having the highest emulsifying properties for mineral oils. Added amounts of soaps, fatty alcohols, solvents, and special types of detergents that retain their scouring properties usually help to take-up mineral oils in colloidal suspension whereby they can be removed as the goods in process goes through the scouring bath. It is well to test the scoured and finished crepes for any trace of mineral oils as it may be necessary to give an additional prescour before the dyeing and bleaching operations.

The different types of boil-off operations may be classified as follows:

For acetate-rayon crepes:

1—Boil-off on Sticks:

The boiling-off of rayon and acetate greige goods on sticks is considered the best method for processing better quality fabrics. The goods are folded in lengths of one yard or forty-four inches, a string is attached to each end and this is put on sticks. These goods are now entered in a box, usually of sixteen feet or any suitable size with proper depth for working in boil-off.

2—The continuous boil-off on specially built equipment with suitable speed and temperature controls is becoming the most widely used as this type of equipment removes so much of the "personal equation" in obtaining high quality goods on a production basis.

The modern continuous systems have been greatly improved upon from the original type where two or more suitable size boxes were hooked together with necessary drums and reels installed in boxes to keep goods circulating for the boil-off and scouring operations.

The goods on entering the older type of continuous layouts were poled by an operative who worked on a raised platform by the side of the boil-off bath without tangling and in open-width so that they entered the scouring and washing operation in satisfactory condition. But not all operatives exercised the same skill and could obtain uniformly processed goods from day to day.

BOIL-OFF AND SCOURING PROCESSING FORMULAS ON DIFFERENT TYPES OF GREIGE GOODS

For acetate-viscose rayon crepe romaine, alpaca and heavy types of crepes:

The greige goods in the "book" or folded form are entered on bent sticks into a water bath at 80-90° F. and steeped for 1 hour or longer. These goods are then boiled-off on these same sticks in a bath prepared on the weight of the processing liquor as follows:

½ to ¾% neutral olive oil soap
¼ to ½% sulfonated fatty alcoholate

The necessary amount of Calgon (meta-phosphate) is used to correct "hardness" of water if it is too high for satisfactory working conditions. Work for one to one and a half hours at 180-190° F. Care must be taken in the handling of the goods so as to prevent cracks or break marks which can usually be traced to the boil-off operation when carelessly carried out by operatives. A warm water rinse is given the goods and they are ready for the dyeing or bleaching operation.

The continuous boil-off method has not proven very satisfactory in the handling of these heavier types of crepes on either the older or more modern equipment layouts. The full width boil-off and rope or semi-width scour have many modifications for this type of work. There are several elements that must be carefully coordinated for successful work; these might be listed as the proper timing of the "feeding-in" of the greige goods and

"take-off" of the creped goods in order to obtain uniform crepeing both width and length-wise. The tension during this operation must be reduced to a minimum to give satisfactory work.

THE "CONTINUOUS" BOIL-OFF AND SCOURING METHOD USED

For Gamzas, 2 x 2s, 4 x 4s, etc., and other lighter weight acetate-viscose crepes.

The boil-off bath prepared on weight of processing liquor is as follows: 2,000 gallons capacity:

¾% (120 lbs.) to 1% (160 lbs.) neutral olive oil soap.
¼% (40 lbs.) to ½% (80 lbs.) sulfonated fatty alcoholate.
1/16% (8-10 lbs) wetting-out agent.
⅛% (20 lbs.) to ¼% (40 lbs.) soda ash or trisodium phosphate.

If water conditions show "hardness" as high as 20-30 PPM., then the bath can be corrected by adding 3-5 pounds Calgon in the cold water before adding the soap and fatty alcohols which must be then boiled-up ready for the prepared boil-off bath.

SCOURING AND WASHING BATH ON WEIGHT OF LIQUOR

¼ to ½% neutral olive oil soap
⅜ to ½% sulf. fatty alcoholate
⅛ to ¼% trisodium phosphate or meta silicate

The necessary amount of Calgon for correcting water "hardness" if necessary.

These two baths can be used to process three hundred to six hundred pieces of greige goods on the usual types of sized greige goods as previously described. The discussion of the maintenance of a uniform pH in the boil-off and scouring baths by the proper feeding in of concentrated liquors from reservoir tanks will be carried through in a later article under laboratory and control methods used in plant work.

There are other types of "ready-made" compounds that can be used for the boil-off bath on this continuous method. These products are usually composed of the following ingredients and they give quite a high pH in the boil-off bath. Some of the plants make up compounds of their own while others buy them ready-made.

Compound No. 1—Used in initial boil of bath.

Sulfonated castor oil	10-14%
Caustic soda	6-8%
Di-sodium phosphate	2.5%
Glycerine or Di-ethylene-Glycol	3-6%
Water	79 to 67%

Compound No. 2—Used in bath at start and fed into boil-off to hold pH up with small amounts of Compound No. 1.

Di-sodium phosphate	30-40%
Tri-sodium phosphate	40-30%
Soda ash	30%

The scouring baths are usually prepared as described above in the article.

The prepared greige goods enter this continuous boil-off bath in full open width as a temperature ranging from 180-208° F. At this high temperature and in open width, the goods are allowed to shrink evenly as time, temperature, and chemical control permit. These goods then leave the boil-off bath over a drum or reel on through a porcelain eye into the scouring and washing bath.

The scouring bath is arranged into sets of compartments, starting at 190-200° F. and after thorough scouring and rinsing of the creped goods they are gradually cooled off in baths of 160-140-100° F. and finally the cold tap water rinse just before the goods are bundled ready for dyeing. Too rapid chilling of acetate-rayon crepes will show up as defective crepe effect and will give a poor appearance on the dyed and finished goods. Twenty to forty minutes is the time required for completing the boil-off and scouring operations on the modern type of "continuous" equipment layouts.

FOR ALL VISCOSE RAYON CREPES SUCH AS PIGMENTED FRENCH CREPES, SAND CREPES, ETC.

Using the "continuous" boil-off method, with the goods beamed on shells.

If greige goods are sized with starch, the following desizing treatment preliminary to the caustic treatment and boil-off can be carried out.

Make up 50 gallons at 130-140° F. with
15 to 20 lbs. Enzyme
10 to 20 lbs. wetting-out agent

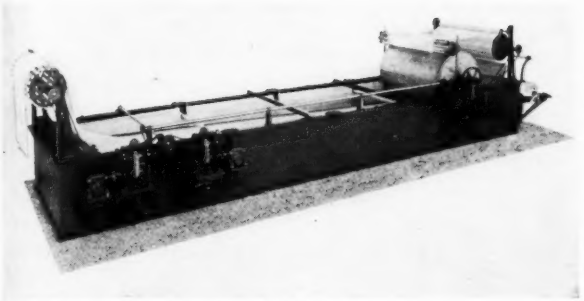
Run goods on quetch open width, beam and allow to set for 2-6 hours, this will solubilize the starch and permit complete removal in the boil-off and scouring operations that follow.

A caustic treatment isusually given the better quality fabrics so to prevent break marks during the hot boil-off and scouring baths. The goods are entered open full width into caustic bath of 2-4° Bé *cold*, this requires 10 to 20 seconds for passage through bath. It is preferable to give the goods a cold, then warm rinse at 120° F. in the open width followed with boil-off and scouring baths as described for the acetate-rayon crepes. To shorten the operation, the boil-off and scouring operations are combined into one processing bath and the goods are run in rope or semi-open form into a bath prepared on weight of liquor.

½ to ¾% Neutral Olive Oil Soap
¼ to ½% Sulfonated Fatty Alcoholate
1/16% Wetting-out agent.

The necessary amount of Calgon can be used to correct water if "hard". After thorough scouring in this bath, the goods are then given hot and cold washes and bundled ready for dyeing in the rope form on winch. The total time required for carrying through these operations ranges from thirty to forty-five minutes.

For all-rayon crepe fabrics requiring the most economical processing method, the following can be used but it is not fool-proof against break marks.



Photo, Courtesy, Van Vlaanderen Machine Co.

Fig. 6—Continuous boil-off machine.

The goods are boiled-off and dyed in the winch or box using:

(On weight of goods)—

1½ to 2½% Caustic Soda (76%) Flakes

Give goods cold wash for 10-20 minutes, drop bath, bring up fresh bath, and add—

4-6% Olive Oil Soap

2% Wetting-out agent

1-2% Soda Ash or Tri Sodium Phosphate

Raise bath to boil, scour 30 to 45 minutes, flush over top of box, drop bath, and start new bath for dyeing operation.

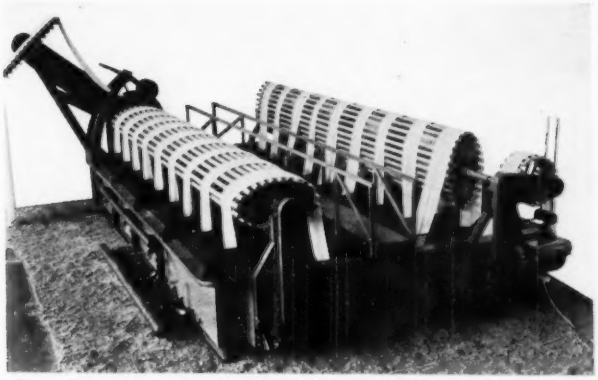
For cheaper type of wabrics, many plants will use this scouring bath for dyeing operation.

THE MODERN LAY-OUT FOR CONTINUOUS BOIL-OFF AND SCOURING

The operatives of these older types of "continuous" lay-outs as well as those operating the modern types overlook the advantages gained from proper speed and temperature control in producing uniformly creped goods from one lot to the next. Another very important advantage gained from the modern lay-out is that of proper circulation through the arrangement of specially designed pumping systems to keep the baths freshened from reservoir tanks and preventing the accumulation of liquor with sizing materials from contaminating the scoured goods.

Figs. 6 and 7 show a modern lay-out for the so-called "continuous" boil-off (Fig. 6) in the open width and the scouring and washing machine (Fig. 7) in the rope or semi-full width that can be used on processing acetate-rayon and all-rayon crepes.

The boil-off machine (Fig. 6) might be better termed the "Initial Wet Treatment" or "Crepe Setting" machine; as the properly prepared greige goods are conveyed from the let-off through a draw roll and around and under the setting drum which is immersed at sufficient depth in the boil-off bath whereby it is kept moist during the processing of goods. This moist drum thus wets out the entering greige goods and starts the crepeing of them evenly at full width as they enter the boil-off bath. The goods entering the boil-off bath either float in open width through the bath or go onto an open width conveyor that carry these goods at the desired speed through the crepeing action of the boil-off bath and delivers them to the scouring and washing machine (Fig. 7).



Photo, Courtesy, Van Vlaanderen Machine Co.

Fig. 7—Scouring and washing machine.

The necessity of controlling the time of processing is shown on this boil-off machine (Fig. 6) as there are variable speeds independently controlling; 1st, the amount of greige goods entering over the drum, 2nd, the speed at which these goods are carried through the boil-off bath, and 3rd, the speed at which the goods are removed from the boil-off bath and then conveyed to the scouring and washing machine (Fig. 7).

Temperature control apparatus is very helpful on maintenance of definite and uniform temperatures from lot to lot of goods.

The scouring and washing machine as shown can consist of different compartments up to twenty or more, this permitting the goods to move progressively from compartment one to two, etc., on up to the final one. Since the goods are picked up by the reels, turned over, and dropped into next compartment they have little opportunity of becaming chilled as in the older types of "continuous" units. Economies are effected in the scouring liquors and wash waters both hot and cold in that goods move progressively toward cleaner scouring baths and then into cleaner rinse waters and finally cold water wash and onto the winding off reel and bundling table.

This scouring and washing unit can be divided into several separate baths which can be circulated through their respective group of compartments. In such a unit consisting of eighteen compartments, the first six would carry the hot scouring bath at 180-200° F., the second bath would consist of four compartments carrying the fresh scouring bath at 160-180° F., then the next two would be hot rinse waters at 160-180° F., the remaining compartments would be in groups of two each with rinse water baths at 140° F., 100° F., and cold respectively. This permitting the creped goods to be cooled gradually and then reeled off onto the bundling table where the pieces are torn apart carefully at the seams marked with the vat or napthol dyed sewing thread. The goods are now ready for the bleaching and dyeing operations.

A scouring and washing machine could be used to carry out a continuous bleaching operation advantageously

but it would be best to have the essential compartments used in bleaching made of stainless steel of the 18-8-S or 18-8-SMO. types.

The circulation system of this scouring and washing machine carry an underflow and overflow of the scouring and rinsing liquors. The baths and goods travel in the same direction thus eliminating the tangling of goods that might occur on the older types of "continuous" units.

In subsequent articles, the bleaching, dyeing, and finishing operations will be discussed.

(To be continued)

Humidification in Desiccators*

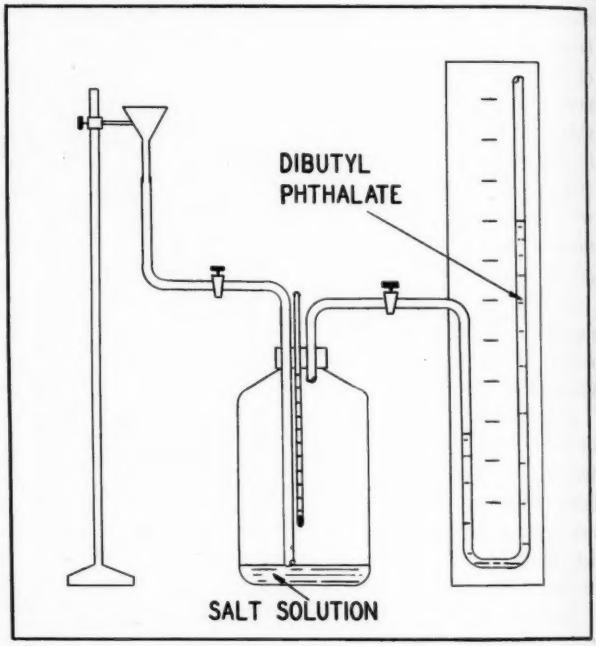
G. BROUGHTON and J. P. MATHER

IN the textile industries it has long been the custom to condition fibers or yarn in an atmosphere of known humidity before testing their physical properties. Frequently for routine work the cotton or other textile is placed in a desiccator over a saturated salt solution which, under equilibrium conditions, will produce the required relative humidity in the overlying air, no attempt being made to keep the desiccator at constant temperature by the use of a thermostat. Recently the question has arisen as to the rapidity of attainment of equilibrium under such conditions and few data appear to be available on the time required for the desiccator air to reach equilibrium with the salt solution. The purpose of the present work was to determine this period, which must be allowed to elapse before the air could be considered to have acquired the desired equilibrium humidity.

The apparatus is shown in the figure, bottles being used instead of desiccators because of their convenient shape and size. They had a cross-sectional area of 281 sq. cms. and a total volume of about 8 liters. After filling with bone-dry or saturated air, they were connected to the manometer containing di-butyl phthalate and the saturated salt solution under investigation run in. The manometer readings were recorded periodically until they became constant, when the air was forced out through a train of U-tubes containing phosphorus pentoxide by displacement with kerosene. In this way the time to attain equilibrium and the relative humidity at equilibrium were determined. The results are given in Table I.

TABLE I

Salt	*Initial Relative Humidity of Air*	*Equilibrium Relative Humidity Calculated*	*Equilibrium Relative Humidity Observed*	*Time for Manometer to Attain Equilibrium*
$MgCl_2$	0	33	35.8	13 min.
	0	33	35.6	15
	100	33	33.2	19
$MnCl_2$	0	55	58.0	23
	100	55	57.3	60
NaCl	0	75	74.8	12
	0	75	71.7	15
	100	75	74.5	15
	100	75	74.2	15



Calculation of the rate of diffusion of the water vapor into the air by the method of Smith[1] making allowance for the fact that one of the gases (air) is stagnant in the present case, shows that in the apparatus used about 97 per cent equilibrium should be reached within 60 minutes. The greater speed attained in practice indicates that convection currents, as well as pure diffusion play an important part.

The results indicate clearly that, under the ordinary conditions used, i.e., no definite temperature control, etc., equilibrium humidity of the air over a saturated salt solution is attained rapidly in a desiccator. Conditioning of samples, therefore, is dependent rather upon their own rate of attainment of equilibrium with the air than upon the rate of humidification of the latter by the salt solution used.

Literature Cited

[1]Smith, Ind. Eng. Chem., *26*, 1167, 1934.

*A contribution from the Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts.

Electric Boiler for Raising

Steam in a Textile Plant

C. H. S. TUPHOLME

AN INTERESTING feature of most of the latest European textile plants is the attention paid to what in the past has been regarded as merely auxiliary equipment, i.e., the plant for raising the heat required in the various processing operations. Today, however, with competition keener than ever, the engineer of the plant has been raised from the status of a kind of general mechanic and handyman to that of the chief chemist himself. The results of such enlightenment speak for themselves in the great majority of cases, for we see, instead of a haphazard collection of plant, anything in fact which will make steam, an array of highly efficient equipment which would do justice to the most modern of central generating stations.

A typical example is to be found in a Swiss textile dyeing and finishing plant, where an electric boiler of a novel and highly efficient type has just been installed for generating the heat required in processing.

It would be as well, perhaps, to give some short account of the boiler, which is of the water-jet type. The principal feature of the water-jet boiler is that the electric current does not flow from immersed electrodes through a stationary column of water, but is conducted through water jets which, as will be described later, radiate continuously from nozzles to the electrodes.

This boiler plant comprises essentially the boiler proper with built-in electrodes, an ejection pipe, a circulating pump with driving motor, the usual boiler fittings and the requisite switchgear.

The three electrodes are arranged concentrically about the vertical ejection pipe, which is provided with three vertical double rows of nozzles. The circulating pump delivers water from the lower part of the boiler into this tube, from which it flows in jets against the electrodes. These are so constructed that the water impinges on their inner surface tangentially, spreads over the inner surface and is so deflected that it acquires a circulative and downwards motion. In this way, dispersion of the water, which would interfere with the electrical conductivity, is prevented. At the same time the centrifugal effect assists the separation of the steam produced from the water.

At their lower ends the spiral shape of the electrodes changes into a circular one, so that a tubular extension is formed which collects the water caught in the spirals and concentrates it into a jet. A sheet-metal cross is built into this tubular extension to stop the circulative motion so that the water leaves the electrode at the bottom in a compact downward jet. The water then impinges on a perforated plate, which is electrically connected with the side of the boiler, and flows through it into the collecting chamber.

In this manner two current paths of constant length are formed per phase between the neutral point of the electrical system, to which the boiler shell and the injection tube are connected, and the electrodes, one of the paths being between the ejection tube and the electrodes, the other between the electrodes and the afore-mentioned perforated plate. Along both these paths the water is heated and evaporated due to its own resistance. Under normal operating conditions the jet water is practically at evaporation temperature, as it flows continually in a closed circuit, so that a very small portion of the electrical energy supplied is used for heating the water, the major portion being used for evaporating it.

Apart from the bushing insulators the boiler has no ceramic parts inside it. Furthermore, the insulators are not immersed in the water. This is important, as it is well known that ceramic parts which are immersed in boiler water are subject to attack and have to be replaced from time to time.

The output of the boiler is regulated exclusively by varying the quantity of circulating water, so that, according to the output, a greater or smaller number of nozzles are in use. Under maximum load, therefore, water sprays on to the electrodes over their whole length and under partial load over part of their length, only. The adjustment of the quantity of water is effected by the throttle valve.

A great advantage of this arrangement is that the water which flows on to the electrodes and serves as a heating resistance is insulated in a closed system. The operation of the electrode equipment is, therefore, independent of the degree of purity and condition of the water used for the actual heating.

The two circuits are thus totally independent of each other, so that the heating water does not come into contact with parts which have an electrical potential above earth. The boiler can, however, also be designed for the direct production of hot water. This latter design is chiefly used for central heating plants.

The standard boiler with hand regulation has the following accessories:—

A steam stop valve, two safety valves, a non-return valve, a feed valve, a sludge valve, a mano-meter, a water-level indicator and a throttle valve in the water circulation pipe for regulating the output.

The boiler can be equipped with various regulating systems:—

(1) *Hand regulation.* Hand regulation is confined to adjusting the output or keeping constant the steam pressure by operating the throttle valve, and to supplying make-up water by operating the feed valve, according to the water level.

(2) *Automatic regulation.* (a) For keeping the pressure or the temperature at a definite value. When the output varies, a pressure regulator (or temperature regulator) is built in, which operates the above-mentioned throttle valve by means of electrical equipment. It is also possible with an automatically controlled boiler to vary the load between practically 0 and 100 per cent of the rated output continually and without trouble.

The operating characteristics of the electric boiler installation referred to are as follows:—

Maximum continuous load: 200 KW., corresponding to a production of steam of about 2650 lb. per hour.
Voltage: 3800-4000 V.
Current: Three-phase, 50 cycles.
Maximum allowable operating pressure: 114 lb. per sq. in.

There is no condensate available for supplying the electric boiler and fresh water is used for the purpose which is fairly hard and which, therefore, must be treated chemically before being utilized. The water-softening plant consists of a softener with Neolite filter, working on the base-exchange process and a maximum volume passed of 50 cu. ft. per hour. The total volume passed between two regenerations amounts to 280 cu. ft. corresponding to one regeneration per day.

The softener is very small and works without any attendance; it is equipped with a water meter, having an alarm device, the duty of which is to inform the attendants of the end of an operating period between two regenerations.

We have here a typical example of an electric boiler plant which does not make use of condensate and in which the relatively hard water available is treated in a chemical water-softening plant, working on the base-exchange principle.

The feeding of the electric boiler with chemically treated water containing a great deal of salt and of low specific electric resistance is possible, thanks to the excellent properties of the water-jet electric boiler. This design allows of using boiler water of high salt content, because the voltage drop takes place along the line of the water spray. The blow-down quantity of water necessary to keep the concentration within the admissible limit and the heat losses which are entailed thereby are small. If it is considered desirable to recuperate the heat carried off by the blow-down water, this can be effected, practically entirely, in a small and cheap heater exchanger.

The chemical water softener according to the base-exchange process has great advantages as compared to other systems as it takes up very little room and is easy to attend. Its running charges are slightly higher on account of the cost of the regenerative salt used, but can be balanced again by using a boiler with its small quantities of blow-down water.

The diagrammatic layout of the whole plant is shown in Fig. 1. The softened water flows from the softener 7 into the feed-water tank 6. The flow to this tank is regulated by a float valve, thus, only that amount of water is allowed to flow through the softener which is utilized in the boiler and, if no water flows through the softener, no Neolite salts are used. The feed pump 5 draws water from the feed-water tank and drives it through the heat exchanger 3 into the boiler 1. The heat exchanger works on the counter-flow principle and is so dimensioned that the blow-down water which flows out of the boiler at about 340° F is cooled down to about 40° F. above the temperature of the feed water, under full-load conditions. Thus, the heat contained in the blow-down water is, practically, all recuperated.

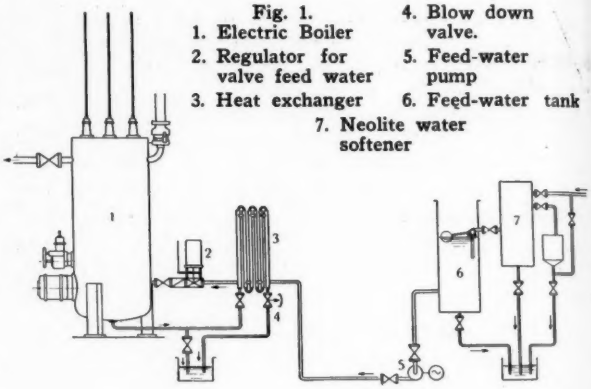


Fig. 1.
1. Electric Boiler
2. Regulator for valve feed water
3. Heat exchanger
4. Blow down valve.
5. Feed-water pump
6. Feed-water tank
7. Neolite water softener

The amount of feed water fed to the boiler is regulated automatically and according to the boiler load.

The quantity of blow-down is regulated by a special valve equipped with a calibrated scale. Thus, the plant attendants can adjust the amount of blow-down to the boiler load. Blow-down regulating devices can be installed which work entirely automatically and which keep the concentration of the boiler water at the maximum admissible value independently of the load or the amount of salt in the feed water.

Further, the electric boiler has a pressure regulating device which ensures that the pressure will be maintained practically constant, when load fluctuations occur between no load and full load.

The high- and low-voltage switchgear is mounted beside the electric boiler. The switchboard layout is such that the control instruments on the board can be kept under easy observation when the boiler apparatus is being manipulated. Thus, the operating conditions of the plant and the way all the organs function can be supervised from the same spot.

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Spun Rayon*

DR. FREDERIC BONNET**

THE rather sudden and surprising increase in the use of spun rayon within the last year or two in the United States and Canada is a subject of considerable interest at the present time. Since it is a product of the rayon industry, it is rather surprising that its use has been so long in developing for ever since there was a rayon or artificial silk industry, waste yarns, broken skeins and tag ends have been sold as waste, garnetted, cut into staple lengths and spun into various yarns. There was, however, never very much of it and what there was, was of varying filament size and length, and was used in the woolen and worsted trade mainly for decorative purposes. However, it is a far cry from this material and the staple fiber as produced today. No longer is it a waste material dependent upon the errors or carelessness of continuous filament rayon production, for it is now being made in large mills and on machines specifically designed to produce rayon fiber of definite filament size and cut to very definite lengths.

In the past few years, its rise to recognition is interesting. However, I will not go into that except to say that Germany and Italy were by necessity pioneers in developing rayon staple and intensive subsidized research was carried on during the depression years with the definite purpose of making these countries more self-contained and less dependent upon foreign sources of raw materials.

This development soon gave evidence that rayon staple

*Presented at the April 29, 1938, meeting of the Rhode Island Section, A.A.T.C.C.

**American Viscose Corp.

fiber had some very interesting properties of its own. The fact that such staple was more uniform in filament size and length made it easier to spin than any natural fiber with much less waste and therefore at lower cost. In addition, the fibers could be made to any specification of fineness with a bright, semi-dull or dull luster, and cut, of course, to any desired length.

This new fiber was found to be very versatile. It offered wide opportunities for the clever cloth designer and it was but natural that keen interest has developed about it. How this interest has grown is clearly indicated in production figures given in the *Textile Organon*. In 1930, the world production of rayon staple was 6,000,000 pounds; in 1936 it was 300,000,000 pounds; and in 1937 it was 600,000,000 pounds, somewhat more than half the total production of continuous filament rayon.

In Europe the point that was made was to have a substitute which would replace the natural fiber and be cheap. In this country, however, this does not hold unless the material has certain properties of its own which makes it of value. We have lagged behind in this world development but last year when there was an increase in filament rayon production of only 2½ per cent, the rayon staple production had increased about 63 per cent.

To indicate the position of both filament rayon and rayon staple in the entire textile field, the following table, based on 26,000,000,000 pounds of textile raw materials, may be of interest:

Cotton	53.7%
Wool	14.5%
Jute	13.3%
Hemp	6.9%
Flax	6.3%
Filament rayon	3.9%
Rayon staple	1.1%
Silk	0.3%

In 1937 the figures were:

Cotton	62.5%
Wool	7.7%
Jute	11.7%
Hemp	6.3%
Flax	5.3%
Filament rayon	4.0%
Rayon staple	2.1%
Silk	0.3%

We are still far from replacing cotton, or for that matter, wool.

In the manufacture of staple fiber the same spinning solutions, pumping of the cellulose solution through multiple hole jets and the precipitation of the fiber are all essentially the same as for continuous filament yarns, the difference comes in the handling of the precipitated fibers after spinning.

For continuous filament rayon the yarn from each jet is collected on a bobbin or in a centrifugal cylinder or box, so that after a definite length of time these bobbins or boxes must be replaced and emptied. The yarn is then treated in skein or cake form through the various chemical processes, given a soft finish, dried and packaged. In the case of the acetate process, the yarn is usually air spun and needs no further treatment except packaging. The continuous filament rayon yarns are handled in small units, say in skeins of anywhere from a few thousand to perhaps twenty thousand yards. In the case of staple fiber, the handling is in bulk. The same spinning frame is used as for making the continuous yarn but the spinning jets have at least ten times as many holes to the jet which means that more spinning solution must be pumped through the jet, assuming the filament size to be the same, and that the spinning solution must be made up on a much larger scale.

At the spinning machines the jets in both cases are immersed in the coagulating bath but instead of the yarn from each jet being collected on a bobbin the threads from the jets on one side of a machine are all collected and drawn off as a continuous tow. Two methods are used in cutting the tow, the dry and the wet. (At this point samples of tow were shown by Dr. Bonnet.) In the dry system the tow is run through the various chemical treatments and comes out as a desulfided, bleached and finished white tow which goes to the cutter. In the wet system, while still wet with acid and under considerable stretch, the raw freshly spun tow is run directly to the cutter and this raw staple fiber is desulfided, bleached and dried in bulk. In the dry steam, the filaments are kept parallel and straight throughout processing, with very little if any crimp. One thing claimed for the wet system is that the fibers do not go through the system under a strain or set condition but are given a chance to shrink and curl, making them easier to spin.

At the present time three filament sizes have become more or less standard, namely, 1.5, 3.0 and 5.5 denier, but heavier sizes of 10 and 20 denier seem to be coming into use. The 1.5 denier corresponds to the average cotton fiber, the 3.0 denier to the coarser cotton, and the 5.5 denier to the regular wool and worsted fiber size. The heavier deniers correspond more to mohair and carpet wools.

The length of the fibers can be readily varied by the setting of the cutting machine. For cotton spinning the standard lengths are about 1-1/2, 1-7/16 and 1-9/16, depending on type of spinning machine. The character of the fiber, therefore, may be changed by substituting coarser for finer filaments, a dull fiber for a bright fiber, etc.

An interesting feature of the staple fiber is its ability to blend with other fibers, making possible rather novel effects in cross-dyeing. The spun rayon may be dyed and the wool or acetate left undyed, or vice versa, or the two fibers may be dyed different colors in the same bath. Last year the majority was processed on the cotton system and went into the challis or linen type of fabric.

When blended with cotton, it has been found that where colors and white were desired in the same cotton yarn, the addition of the bright rayon staple made the cotton appear a cleaner white and incidentally the stock dyed cotton colors seem much brighter and more brilliant. Rayon staple gives much softer and more pliable yarn than cotton and the degree of softness may be regulated by the ratio of the blend and by the filament size of the spun rayon. Cotton fabrics are not as absorptive as those made of spun rayon of the same type and construction. This has led to a well known towel manufacturer putting out a dish towel containing cotton, staple fiber and linen blended together so as to get a strong fabric with good absorption and freedom from lint.

There is another thing in regard to this subject of change of filament size. In one case a yarn manufacturer used stock dyed cotton fiber and had blended it with 1.5 denier undyed staple. It gave a very nice sort of brindle effect but was not what he wanted. A competitor was making a yarn which had a wooly effect which he was trying to obtain. Analysis showed the wooly effect was obtained merely by using a coarser rayon fiber which gave the effect desired.

Blends with wool are of many kinds and the spinning is done either on the wool or worsted system. In the former, mixes of various wools or other fibers are made on the floor. In the processing and blending which follows, intertwining and felting of the fibers take place. It is this system of wool blending which has consistently used rayon waste for years. Any irregularity in the staple fiber is of no particular drawback, but rather aids the effect desired in wool spinning.

In the worsted system, however, where the fibers are combed out and kept parallel as in cotton spinning, blending is often done at the gill box. Hence, in this type of spinning regular staple fiber of uniform size and length gives the better yarn. This type is being used in suitings. When worsted manufacturers first tried blends with staple fiber they expected the resulting yarn to be of lower strength but much to their surprise found that as the percentage of rayon staple in the blend increased the strength also increased.

While viscose, cuprammonium, and acetate rayon staples are finding increasing markets, other spun staple fibers are making their appearance. Thus, Italy has brought out under the name of "Lanital," a staple spun from Casein. The Casein is obtained from skimmed milk, and a suitable solution of this is spun in the ordinary way through spinnerettes into an acid bath which coagulates the Casein into filaments which when treated with formaldehyde are converted into the textile fiber "Lanital." Being a protein material it takes the same dyes as wool, has the same burnt hair odor as wool when ignited and its empirical formula shows practically the same percentage composition of the elements but this would be equally true of almost any other protein. "It resembles a highly damaged wool, and its main disadvantages are a very low tensile strength and its reaction to acid," according to a report of the National Association of Wool Manufacturers. Other proteins, e.g., those of the soy bean are experimentally at least being spun into staple. With a great deal of work being done on such protein fibers, considerable improvement may be expected.

Quite a number of new viscose and cuprammonium types of fibers are being produced in Germany to replace as many of the natural fibers as possible. There is the Hofa fiber which has been developed to replace bast fibers, jute and hemp, while Vistra fibers cover quite a range as wool substitutes. One of these has a round or oval cross-section like wool with a roughened surface and a crimp. There are also the hydrophobic or water repellent types. Some of these have the appearance of wool which has led to some confusion in the trade that they are of Casein origin.

Staple fiber made from acetate fiber has been referred to and is taking on increased importance and wider uses are being found for it since it is now being supplied in sizes ranging from 1.5 to 20.0 denier in any desired length.

The stronger types of viscose fibers are being spun giving an increase in strength of about 36 per cent.

DYEING AND FINISHING

The dyeing of spun staple offers no more difficulty than continuous filament rayon, cotton or wool for it can be stock dyed, skein dyed or dyed in the piece quite as easily but it must not be assumed that all staple fiber made by the same process as for example, the viscose, are all the same in strength, spinnability or dyeing qualities.

There are two systems commonly used in stock dyeing. One is the so-called vacuum system in which the dye liquor is circulated through the mass of the staple. In the other system the stock is put in a large perforated drum which revolves in the dye bath. The vacuum system gave some trouble at first because of a lack of understanding of the nature of the rayon which swells a great deal more than wool. It is essential that the raw stock from the bale be thoroughly opened and uniformly spread in the machine. It is best to allow the liquor to flow into the machine gradually from the bottom so as to displace the air until the liquor overflows when circulation by means of the pump may be started. It is also advisable to use wetting out agents in the dye bath and the dyeing should be done practically at the boil. The choice of compatible dyestuffs is also important if best results are to be obtained.

The finishing of rayon staple fiber types of fabric is rather important if they are to render their greatest usefulness and give consumer satisfaction. As mentioned above, in general, fabrics made of fine spun rayon staple are very soft and pliable with excellent draping qualities while those made with the heavier deniers are somewhat less soft. There is, however, one very bad feature they all have and that is their tendency to crush and wrinkle rather badly.

This is particularly true with the woolen or worsted type fabrics. Wool fibers have a certain resilience or springiness due to the true elasticity of the fibers, which property, we are sorry to say, is essentially lacking in the rayons and spun rayons as made today. The old oil and sulfonated oil and wax finishes when applied to spun rayon fabrics do not improve this condition. Moreover, these old oil finishes are apt to cause the fabric to have a peculiar rancid odor which if not present at first usually develops during storage of the goods. This is quite objectionable and has led to the investigation of the so-called synthetic resins and some remarkable results have been achieved. This development, however, is only in its infancy as yet. These resins or resin condensates were primarily developed as plastics but already they threaten to entirely displace the older finishes. Some of these are made from urea-formaldehyde, poly vinyl alcohols and acrylic condensates, to mention but a few, and show considerable promise in the textile field not only as finishes but as sizing materials to displace the unstable starches, gelatines and gums in use today.

These resins are, as a rule, applied in a water soluble form together with the necessary catalyst and plasticizer, at the quetsch, in order to get uniform distribution, after which the fabric is heated in the presence of steam to a rather high temperature—260-280° F. in the case of urea-formaldehyde. This renders the resin quite insoluble and permanent. The addition of plasticizer controls the degree of softness of the finish. Certain of the urea-formaldehyde resins will also impart resiliency to the fibers which otherwise would be lacking. In the same way, other resins will make the fabric water repellent and spot resistant.

It is desirable to have water clear solutions as they have little or no effect on the brilliancy of the colors and in no case should the resin impart any appreciable odor to the goods. The high temperatures which seem to be necessary for curing or setting these finishes are objectionable because of their effect on the fibers as well as on the dyes. Intensive work is under way to correct this condition and make the resins less expensive and easy to apply as well as rendering the resin insoluble around the boiling point of water so that there will be no action on the rayon nor the dyes and will not be appreciably removed in laundering or dry cleaning. Some of the resin finishes on the market today meet quite a number of these conditions. Some of these finishes also impart a resiliency to the fabric so that it shows little tendency to crease.

Another type of textile fiber which may be of interest to mention is spun glass. Both yarns and certain fabrics are now being made of it. It is finding uses largely at the present time in industry for filter cloths and high temperature insulation. (Several types of filter cloth were shown which were made of spun glass staple made by the Libby-Owens Co. and a transparent slab of synthetic resin the same type as applied in finishing textiles).

It is evident, from what has been said, that spun rayon is bringing about a wonderful textile development.

DISCUSSION

Q. Can you give the United States figures on the filament rayon as well as the spun rayon?

A.	1935	1936	1937
Filament rayon	257,557,000	277,620,000	312,236,000
Spun Rayon manuf.	5,200,000	12,400,000	20,000,000
Imported	146,000	12,718,000	20,250,000

Q. On the rugs, how were they treated with anti-crease?

A. The dyed yarn blend was treated in the yarn or skein form. A better way would probably be to treat the rayon as roving. The carpets themselves were not treated.

Q. What is the base price of spun rayon per pound?

A. The present price is 25c per pound.

Q. What about filament rayon?

A. The price of 150 denier is 54c.

Q. Why is spun rayon only half the cost of filament rayon?

A. As we mentioned above the continuous filament yarn is spun with much smaller jets and is collected on bobbins or in spinning boxes. This involves smaller production and much more handling in smaller units. Spun rayon on the other hand has a much higher production rate and is handled in bulk.

Q. In top dyeing how large a top would you recommend for spun rayon?

A. About 20 lbs. on a spool is commonly used.

Q. Would you recommend a two-way pump?

A. A two-way pump no doubt allows better penetration as in ordinary package dyeing.

Q. Is there a way to prevent those tops from falling when you shift your flow of liquor?

A. We have not found that to be the case. You must be careful not to wind too tight or too loose. Rayon swells when it is wet. Bobbins must be wound with considerable care for any which are too tightly wound will not permit the same volume of dye to pass and will come out a lighter shade than those bobbins more loosely wound.

Q. Have you been able to detect any protein material in the fiber known as Cisalfa?

A. A good many samples of that material have been analyzed but no appreciable amounts of any protein material have been found in the fiber. If there is a trace there is apparently not enough to change the dyeing or other properties appreciably from a straight viscose type fiber.

Q. Tell us something about hollow spun fiber.

A. Hollow fiber continuous filament yarn was made some years ago and was called Celta. It is usually spun in such a way that gases are liberated within the fiber as the acid of the precipitating bath gradually diffuses into the core of the fiber. Such yarn while quite light, soft and lofty with a good cover is quite low in strength and has not found any extensive market.

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DR. CHARLES H. HERTY

CHARLES H. HERTY

DR. CHARLES H. HERTY, one of the greater champions of the American chemical industry, died of a heart ailment on July 27th at Savannah, Ga. He was 70 years old.

He was born on December 4th, 1867, at Milledgeville, Ga. He was educated at the University of Georgia, John Hopkins, Berlin and Zurich, and from 1894 to 1902 was instructor and assistant professor of chemistry at the University of Georgia. For two years he served with the Bureau of Forestry, U. S. Department of Agriculture, after which he was professor of chemistry at the University of North Carolina, a post he held from 1905 to 1916. From 1917 to 1921 he was editor of the Journal of Industrial and Engineering Chemistry. For the next five years he was president of the Synthetic Organic Chemical Manufacturers Association and from 1926 to 1928 was advisor to the Chemical Foundation, Inc.

Dr. Herty was elected to the office of president of the American Chemical Society in 1915. He was also awarded with the medal of the American Institute of Chemists in 1932, and with the Herty Medal of the American Chemical Society, named in his honor, in 1934. He was a member of many other scientific societies both here and abroad.

The last ten years of Dr. Herty's life were devoted to one project—to tap the vast pine forest reserves of the South and convert them to useful white paper or newsprint, that would not only bring vast wealth to the South but would make America independent of foreign newsprint. He lived to see the day, last January 15th, when the first unit of a $9,000,000 pulp mill was dedicated at Fernandina, Fla., and heard Secretary of Commerce Roper congratulate him for his leadership in developing the paper industry of the South. It is expected that this industry will eventually reach billion-dollar proportions. Members of the American Association of Textile Chemists and Colorists will recall that he discussed this project at their annual meeting held a few years ago in New York.

He has made many other important contributions to the chemical world, including the development of methods that put the American turpentine industry on a sound basis. While working on his pine forest project he also devised new processes for extracting wealth in other ways from pine, including a process that makes it possible to use the cellulose for rayon as well as a method to separate from the pines a species of fat said to resemble fats obtained from animals.

On the day of his death, flags on the City Hall and Court House at Savannah were at half mast, in respect for him. Early this year he was denominated "the man of the year for Georgia and the South".

American chemists regarded Dr. Herty as one of the greatest of their profession and the American chemical industry will surely miss the wise guidance, counsel and energy that marked his life.

He was married in 1895 to Miss Sophie Schaller, who died in 1929. He is survived by a daughter, Miss Sophie Dorothea Herty of Savannah, Ga.; two sons, Charles H. Herty, Jr., of Bethlehem, Pa., and Frank B. Herty of Brooklyn, N. Y., and a sister, Mrs. W. D. Hooper of Athens, Ga.

Package Dyeing

of Cotton Yarns

HENRY K. TORPEY

BECAUSE package dyeing is a more recent development than skein or long chain, sometimes it is considered to be difficult and tricky, and many firms considering new installations shy away from it. Nothing could be further from the truth. The dyer who runs package dye machines for a little while will become an enthusiastic supporter of this type of work, for it gives results which, for economy, speed, and reliability are excellent. In no other form of dyeing will a formula run so regularly and so true as in package. There are vat formulae which have not been changed for five years and no appreciable variation can be seen in the shade obtained.

Naturally, there are many points which require careful watching, and we will consider some of these.

First, the winding. This must be as uniform package to package and day to day as human ingeunity can make it. Some dyers like their packages wound very soft, while others prefer a hard wind, but, hard or soft, uniformity is of the greatest importance. Since yarns for package cover a wide range varying from single 4's to 40/2, 60/2 and 100's, this is not always easy, and requires close cooperation between the winder and the dyer. Size of packages is important, for economy demands that the package be as large as is consistent with levelness from inside to out. Except on the finest yarns which pack firmly on the tube, the size can be limited only by the available space between spindles when dyeing, enough space being left to insure complete unhampered circulation.

In all types of dyeing the condition of the machine is of great importance and nowhere is this truer than in package dyeing. Pumps, spindles, caps, and gaskets must be kept in good condition if good results are to be obtained.

There is a tendency in some quarters to stint the time allowed for dyeing packages, and especially the time of the preliminary boil. Some even go so far as to eliminate this boil completely. For direct colors which are to be used in a cheap line of work this can be done, but it must be understood that quality is being sacrificed to speed and economy. The dyer who wishes to economize in this way should make haste slowly, for one batch which must be redyed can steal the profit made on three or more good batches.

For vats, naphthols and other high quality work there should be a good boil out, always. A combination of caustic soda and sulfonated oil is quite satisfactory. For penetration in the actual dyeing, the soaps of the higher fatty alcohols are ideal. As little as 5 ozs. per 100 gals. of liquor will work miracles and the cost is not prohibitive. Where hard water is encountered this amount may have to be increased.

Probably the most important point to be considered in running package work is the wise selection of dyestuff. No other factor can do more to make or destroy the reputation of this class of work. There are few dyes which cannot be used for packages, but many which require special mixing, special temperatures or special working conditions. Package machines are made with a two-way circulation, from the inside of the package out, and from the outside in. In practice most dyes will work with only outside to in circulation, thus simplifying the running, others must be added in several portions and with reversal of flow to insure even results. As a general rule direct dyes work best at temperatures from 180 to 200° F. but there are some which level best at 140 or even lower. Care should be taken that dyes used in combinations are approximately equal to levelling qualities and rate of exhaustion.

In vat work, the dyestuff manufacturers recommend certain temperatures for each dyestuff. In practically every case it is good policy to run package work from 5 to 15 degrees lower than this. This will help levelness. The human element enters here, for an operator is much more inclined to get the machine too hot than too cold, and it is much more difficult to cool than to warm. So play safe and keep a low temperature. There are three general classes of vat dyes represented in Indanthrenes by the letters IN, IK, and IW, besides a few special dyes. It is not always possible to use dyes in combination which come in the same class, but, except in very few instances, these can be used together, the ideal temperature for the combination being found by experiment. Certain dyestuffs which are listed as dyeing at 140 deg. will dye equally well from 110 to 190, while others must be kept within definite bounds. When two dyestuffs of greatly different reducing temperatures are used together, each can be vatted separately but dyed together.

While the dyestuff is reducing, the machine should be primed with a small amount of penetrant, caustic, hydro, and a colloidal retardent. Fifteen minutes is sufficient in most cases. When the dye is ready the machine is ready and no time is lost. Time of dyeing is important. Tests will show that many vat dyes are exhausted in six

minutes, but levelling is still going on through the fiber and through the packages. Forty-five minutes is a good average time for good work. Since an excess of alkali may possibly cause unevenness, the amount of caustic should be kept as low as is consistent with good solubility.

Vat colors need to be oxidized and there is a wide difference of opinion as to the best manner of accomplishing this. Where the type of machine so allows, the batch can be lifted out of the dye and oxidized by drawing air through the packages on a vacuum table. While this is being done a sample can be taken and finished by hand. Other types of machines vacuum right in the machine. This is followed by a thorough washing, development with perborate or bichromate, washing and soaping. For deep shades where a large amount of alkali has been used it may be best to sour with a little sulfuric acid before the perborate. On light shades this can be eliminated, and the soaping left out. This then becomes—air oxidation, cold wash, warm wash, perborate and final wash.

Some work has been done by oxidizing with chemicals right in the original liquor, before washing. This is tricky and apt to be expensive, so care must be taken in selecting shades which are adapted to this method.

Naphthols run well in package machines with perfectly level results. Since there are no general rules for naphthols, each one being a law unto itself, we can skip many details, mentioning only these. There is no need for drying between impregnating and developing as a thorough washing will serve. Thorough soaping after developing is imperative if the yarn is to be made reasonably fast to crocking.

Indigosols can be run in package by following the established rules for this type of dye, but as vats will give the same results at lower cost there is little need for them. Developed colors need no special directions, the general precautions for directs will serve. For brightest shades the machine should be made of stainless metal, as all new machines are.

Sulfur colors present a problem in straining, for any impurities or undissolved particles will filter out on the packages, so care must be taken that all materials are well dissolved and well strained before adding. Sulfide should be clean and a slight excess used. As little salt as possible is used as an excess will cause unevenness. In fact, for all types of work salt should be kept at a minimum. A good grade of common salt will serve in all cases and no Glauber's salt need be used. This is a matter of individual taste, but also a matter of economy.

Package machines are ideal for peroxide bleaching of cotton yarns, as a good white is obtained in a relatively short time at no great expense and with a minimum of floor space. For the finest, most absorbent whites on low grade stock, a preliminary pressure boil is given, much as in kier work, but in the same machine. For most work this is not necessary, the boil-out and bleach being combined in one run, saving time, money and the fiber. Any higher chemical cost is more than offset by simplicity and speed of production.

When dyeing or bleaching is complete, we still have to dry the yarn. Originally, the packages were taken from the machine, packed in a hydro-extractor, whirled free of excess moisture, then dried in a tray drier. The packing in the extractor and in the trays pressed the packages out of shape, making rewinding necessary and difficult. Later individual extractors were developed which held one package at a time in each compartment and which is quite efficient. A still better system vacuums the batch right on the carrier, then dries the yarn by blowing warm air through it. This has all the advantages of little handling, packages in good shape, and speed. Batches are dry in from 3 to 5 hours, depending on size and type of yarn.

This paper treats of package dyeing in general, making no attempt to choose between rival types of machine. Each type has its advantages but all will do good work if reasonable care is taken. Package dyeing is growing more important each year as designers and dyers develop better machines and finer technique. Work done on this system grows better each day. A few years ago it was not deemed possible to dye worsted yarns or rayons by this method, yet this is being done in many plants. But this is about cotton yarns, the rest is another story.

TRADE NOTES • NEW PRODUCTS

• WORLD CHEMICAL DEVELOPMENTS

Expansion of production facilities, the inauguration of new industries, stocking for emergencies, and governmental interest in chemical manufacture were outstanding features of world chemical developments in 1937 according to a world survey of the chemical and allied product industry made available recently by the Commerce Department's Chemical Division.

The chemical industry of the world during 1937 continued the progress made in the preceding years; there was considerable improvement in the financial condition of the chemical industry which in many countries recorded the most prosperous year since 1929, the survey shows.

Strong nationalistic and rearmament programs encouraged the rapid progress of manufacture of chemical products, especially in European countries, notwithstanding that sometimes these new industries were uneconomic. The industry on a few occasions for short periods was hampered by interruption of raw material supplies by conditions existing in supplying countries, but at no time was the condition serious.

Foreign chemical trade in 1937 considerably exceeded preceding years and was the largest since 1929; the loss or reduction of purchases in certain regions was more than offset by increased purchases in other countries.

In South America the chemical market was influenced less by these events than elsewhere, though competition from certain European countries was keener and the almost world-wide self-sufficiency movement was evident in the area, the survey reveals, according to the Commerce Department report.

Accentuated rearmament programs continued in almost all European countries and brought about increased production and demand for many chemical products. The peak at which iron and steel industries operated was reflected in increased output of coproducts, statistics indicate.

The continued civil war in Spain reduced chemical exports from European suppliers to that country and caused them to seek foreign outlets elsewhere, as well as to look for new sources of supply for certain raw materials formerly supplied by Spain. Despite conditions in Spain, however, that country exported 2,292,000 metric tons of pyrites last year against 1,985,000 tons in 1936. The withdrawal of Spanish potash from world markets was automatically taken care of by the International Potash Cartel, according to the survey.

Italy reentered world chemical markets with products which had been temporarily withdrawn during the Ethiopian campaign. An outstanding effect, so far as the United States is concerned was the resumption of Italian sulphur shipments to markets which obtained their sulphur requirements from the United States during 1936.

In the Far East, the Sino-Japanese situation tended to disorganize trade in that region during the latter part of the year and resulted in much of Shanghai's normal business being rerouted through Hong Kong. Despite these conditions, however, China was able to export an all time record quantity of tung oil to world markets, particularly to the United States, its leading foreign market for this essential raw material, statistics reveal.

In most European countries and in Japan there was almost complete control of foreign trade in one way or another, but imports of essential raw materials were, in most cases, admitted freely.

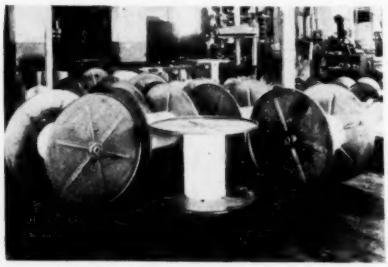
No significant changes were reported in connection with the large international cartels, such as those controlling international movements of nitrogen potash, chlorates, dyes, sodium sulfate, alkalies, calcium carbide, cyanides and certain fine chemicals.

It would be impossible to make an exhaustive study of every country, hence the selection in this bulletin is based on the significance of the industry within the country, the importance of the country as a market for American chemicals, or the advent of chemical manufacturing.

The Survey "WORLD CHEMICAL DEVELOPMENTS IN 1937," known as Trade Promotion Series No. 177, can be obtained from the Superintendent of Documents, Washington, D. C., or from any of the Department's District Offices, located in the principal commercial centers of the country, at 25 cents per copy.

• STAINLESS TAKE-UP REELS

Manufacturers of sash cord have found that rust spots following the final finishing and polishing operation can be eliminated by the use of take-up reels constructed of stainless clad steel. Such reels have recently been manufactured by the Mossberg Pressed Steel Corporation of Attleboro, Massachusetts.



Take-Up reels of IngAclad 18-8 Stainless Clad Steel have eliminated rust spots in finishing sash cord. Fabricated by Mossberg Pressed Steel Corp., Attleboro, Massachusetts.

After the sash cord is braided on a solid cord machine, it is finished and polished on a multiple strand finishing machine. The cord is immersed in a solution containing starch and passed through the polishing head in multiple strands. From the polishing head the sash cord, which at times still contains an amount of moisture, is taken up on the reels.

In using ordinary steel reels, rust spots on the finished cord were frequent. In the Mossberg reels the sash cord is in contact with the stainless steel surface of the clad steel, which, it is claimed, has eliminated any possibility of rust.

While this use of stainless clad steel is relatively new, users report that they are a marked improvement over the former steel take-up reels.

The reels illustrated were photographed in the plant of the Mossberg Pressed Steel Corporation. They are 32" in diameter, 20" wide, with a 12" diameter drum. The heads are grooved to accommodate a cord friction drive and are formed of ⅛" IngAclad, having a 20 per cent layer of 18-8 stainless steel bonded to ordinary steel, as supplied by the Ingersoll Steel & Disc Division, Borg-Warner Corporation, Chicago, Illinois.

• IMPROVED MIXER

The Mixing Equipment Company of Rochester, N. Y., has added a new feature to their popular line of Lightnin Portable Mixers in their guarantee of "no grease in the mix." This is important to every manufacturer of products sensitive in flavor, appearance, etc. to small amounts of oil or grease.

Using a new type pre-lubricated sealed ball bearing in the important extended bearing, the manufacturer absolutely guarantees that no grease or oil will ever run down the shaft, either from operation or careless lubrication. This improved method of grease prevention was selected after exhaustive tests of seals, oil traps, etc., covering a period of three years.

It is stated that many of the seals tested were satisfactory for definite periods, but no seal will last indefinitely. Thus sooner or later a valuable batch of material would be spoiled. Seals also caused definite wear of shaft or tube which are customarily of a corrosion resisting alloy.

The life of the sealed ball bearing, after exhaustive breakdown tests, is expected to be even longer than the standard bearing due to adequate lubrication and because no grit or dirt can possibly enter this bearing.

Maintenance at this point is thereby reduced to zero and a double saving in time and lubricant is made, it is said.

Careful engineering has made it possible to add this feature at no extra cost. Replacements can be made on existing mixers in use at the usual low charges for replacements and repairs.

• BUFFUM RESIGNS

Resignation of William W. Buffman, Treasurer of the National Farm Chemurgic Council, has been announced by Wheeler McMillen, Council President. Mr. Buffum, as Treasurer and General Manager of The Chemical Foundation and President of the Atchison Agrol Company, will devote the major portion of his time to development of the Agrol industry as now exemplified in America's first power alcohol plant at Atchison, Kansas.

Mr. Buffum was one of the founders and member of the original Board of Governors of National Farm Chemurgic Council. The development of power alcohol has provided one of the major toipcs of discussion at the annual and regional conferences of the Council. Early this year the Atchison plant, which manufactures anhydrous ethyl alcohol from midwestern farm crops, was established as a complete commercial operation known as the Atchison Agrol Company. Distribution of the alcohol and gasoline blended fuels now covers nine midwestern states under the trade name "Agrol."

Together with Mr. Buffum, Dr. Leo M. Christensen and Dr. Harry Miller, Directors of the Agrol Company, are resigning their other connections and committee memberships in order to give full time to further development of the Agrol industry.

In accepting Mr. Buffum's resignation, President McMillen said:

"Your resignation as member of the Board of Governors and as Treasurer of the National Farm Chemurgic Council is regretfully accepted. Your splendid enthusiasm for the Chemurgic movement has been a great force from the beginning of our organization. I am glad that your resignation comes not because of lessened interest but because of your wish to be free to give undivided attention to the important power alcohol project. The sound advancement of that project deserves the best of available efforts."

• pH PAPERS

Paul Frank, 456 Fourth Ave., New York City, announces the sale of pH papers to determine pH values in acid or alkaline solutions, simply, instantaneously and dependably. They consist of strips of a special paper, inpregnated with a highly sensitized indicator and a scale of color bars, each bar being of a different color and having a definite pH value. When the strip is dipped into the solution the indicator will change color. By comparing the color of the indicator with the colors of the color-bars, the pH value of the solution can easily be ascertained.

• PURCHASE JOHN CAMPBELL

The American Cyanamid Company announce that they have disposed of their interest in John Campbell & Company, Inc. to a group of Campbell employees who will continue to supply the consuming trade as heretofore.

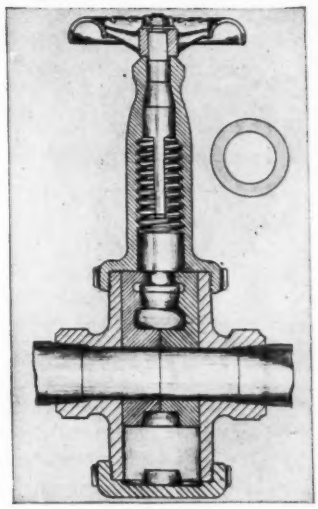
The main office will be continued at the same address as before, 75 Hudson Street, New York, N. Y., with branches in Philadelphia and Boston.

• NEW VALVE

The Monat Valve and Forge Company, 924 Bessemer Bldg., Pittsburgh, Pa., has recently developed a packless, cylindrical gate valve, suitable for high as well as low pressures and temperatures.

This new, rugged valve, designated as the Monat "Stream-Flow," contains the salient construction features of both gate and plug valves but none of the disadvantages of either. There are no cavities and friction is eliminated. It is available in sizes ranging from ½" to 8" in the standard metals. Also in special metals and alloys for lines handling corrosive liquids and gases.

The body of this new valve carries a cylindrical bore, at right angles to the



line of flow. A cylindrical gate is moved up and down by means of a screw in the valve bonnet, and is prevented from turning by a key in the cylindrical bore. The run of the valve conforms in shape and size to that of the pipe—namely that it is circular.

No packing is required. The only operating part in the line of flow is the gate itself. A cap on the bottom of the body and the removable bonnet permit cleaning the valve while it is in the line.

Monat valves are used for steam, oil, gasoline, varnish, food products, gases, air, etc. The manufacturer will be pleased to forward literature and prices upon request.

• CONSUMERS' TESTING LABORATORIES

Announcement is made of the formation, several months ago, of the Consumers' Testing Laboratories, 44 N. Seventh St., Philadelphia, Pa. This laboratory was organized by Herbert S. Schenker who previously was chief textile consultant with Gimbel Brothers Bureau of Standards. A commercial textile testing laboratory is maintained in Philadelphia, catering primarily to retailers and manufacturers of wearing apparel. They act as the official textile testing laboratory for the Better Business Bureau of Philadelphia, and for the Retail Bureau of the Philadelphia Chamber of Commerce. Their work is concerned chiefly with the determination of "consumer serviceability" of textile materials.

• CIBA REVIEW

Number 11, *Ciba Review,* has recently been distributed. Featured in this number is "The Early History of Silk." Articles enlarging upon this subject are described by the following titles: The Origins and Rise of Silk, The Lavish Use of Silk among the Ancient Peoples; Silk and Style; The Growing, Weaving, and Dyeing of Silk in the Ancient Orient and in Classical Antiquity; Silk and the Development of Trade; Historical Gleanings. Also included with this number is a supplement entitled "New Vat Printing Products" which contains printed patterns which have been produced with new Ciba specialties suitable for cotton, rayon or silk. They yield solid prints of good tinctorial value said to possess good to very good fastness to washing, chlorine and light. There is included a further supplement showing 4 per cent Neolan Navy Blue 2 R L conc. on indigo dyed ground.

• HYDRION TEST PAPER

R. P. Cargille, 118 Liberty Street, New York, N. Y., announces the distribution of the new Hydrion wide-range test paper for rapid determination of approximate pH value. The paper is used just like litmus paper except that it gives five color changes in the range of pH 2 to pH 10. It is stated that they can be used with turbid and highly colored solutions by observing the color of the outer diffusion zone on spot tests.

• NATIONAL RELEASES

National Aniline & Chemical Co., Inc., 40 Rector Street, New York City, has issued bulletins describing the following products:

National Milling Black B—a neutral dyeing acid black which possesses the general fastness properties of the National Durol Blacks with the added advantage of being readily discharged. On wool National Milling Black B yields bloomy shades of black said to be of excellent fastness to washing, sea water and water and of very good fastness to fulling, perspiration and light. On union goods, wool and silk are dyed while cotton is stained considerably. Pure silk is dyed somewhat deeper than tin-weighted silk and, on discharging, yields somewhat purer whites. Bulletin No. 222.

National Brilliant Indigo KMR Double Paste—possessing the same general fastness properties as the other Brilliant Indigos but producing a deeper and more covered shade. For this reason it is of particular importance for the production of cheap navies said to be of good fastness to light and washing. It may be applied either by dyeing or printing to cotton, rayon or pure silk. Bulletin No. 223.

• QUARTERLY PRICE LIST

The Quarterly Price List for July, 1938, issued by the R & H Chemicals Dept., E. I. duPont deNemours & Co., Inc., has recently been distributed. Copies are available upon request.

• QUAKER RELEASE

Quaker Chemical Products Corp., Conshohocken, Pa., announces the production of:

Quaker XX Oil—a 50 per cent sulfonated oil, produced from an all vegetable base and intended for use in textile processes, dyeing, finishing, paper coating and wetting out operations. It is said to be considerably cheaper than similar product on the market.

• HEALTH HAZARDS

The Commonwealth of Massachusetts, through the Division of Occupational Hygiene of the Department of Labor and Industries, has released a booklet on woolen and worsted goods manufacture dealing with the subject of occupational health hazards in Massachusetts industries. The booklet describes a survey which is one of a series of industrial health studies conducted by the Division, in cooperation with the W.P.A. This survey was supervised by Hervey B. Elkins, chemist of the Division. Copies of the booklet are available.

TECHNICAL NOTES FROM FOREIGN SOURCES

The Natural and Artificial Fibers and Their Mutual Relationships

Prof. Dr. Haller—Mell. Textil-Ber. 18, 617 (1937).—The first section of a paper read before the twentieth congress of the I.V.C.C. in Salzburg, in June, 1937.

The present section is of a mainly historical nature (historical, that is, not going back into remote historical times, but beginning with the modern period, with the work of Chardonnet upon nitro-silk). The author touches briefly upon the various sorts of artificial fiber which have gained any textile importance, ending with the latest one of any interest, namely, casein silk, as one which has really begun to be employed to some extent, at least, on the industrial scale; and at this point, to afford a clue to his further discussion, proposes the question "Has the technique of the artificial fibers yet produced a fiber of value, even in structure, equal to the natural fibers? Has our more refined technique succeeded in reconstructing, in the artificial fiber, those structural characteristics which are so important for the physical as well as the chemical properties of the natural fiber?" This question, according to our present state of knowledge, he considers can be answered only with a decided "No."

A careful review follows, of the details of structure of the natural cotton fiber as an example. The natural cotton fiber, as it comes from the plant, is coated over with a very thin layer of substance which does not at all form an actual outer membrane of homogeneous nature, and differs from the actual cell-wall in its chemical properties, and consists of a deposition, in or on the outer cell-wall, of substances very different from the cellulose within. This non-cellulose layer consists of substances known in a general way as waxes, fats, coloring matters, pectin substances, etc., which are not related to or combined with the cellulose chemically, but merely in a loose physical way. Further, by chemical deposition of certain homogeneous chemical substances by precipitation, for example, copper ferrocyanide, upon regenerated and therefore homogeneous (as far as we know) cellulose fiber, a structure is produced which displays a behavior similar in some ways to that of natural cellulose fiber, toward copper-oxide-ammonia, in particular. And, further, the cotton fiber displays a decidedly lamellar structure, which, after the action of swelling agents, is visible under the microscope without the use of special means of illumination. And, lastly, natural cellulose possesses a more or less characteristic ultra-structure, visible under the microscope, with dark field illumination.

All these characteristics are closely connected with the chemical, and far more so with the physical, properties of the fiber. With them may be contrasted the properties of the artificial fiber, for example, either viscose or cupro fibers (rayons), which are sections cut off at will from the theoretically endless fiber issuing from the spinneret. The question is, how far have we succeeded in imitating (we call attention to the fact that the author rightly uses the word "imitate," instead of the usual and presumptuous "reproduce") these peculiarities of structure of the natural fiber? (The author speaks of the artificial fiber, but surely it is the natural one which is meant?)

To attempt to coat the artificial fiber, to produce a similarity to the natural fiber, would evidently be worthless, since this coating upon the natural fiber has to be removed by kiering before the fiber can be worked up. As to the lamellar structure of the natural fiber, this is a matter of much greater importance, since it appears that this structure is responsible for the great tensile strength of the cotton fiber. The author does not recall that any attempts have been made, as far as has been published, to reproduce this structure in an artificial fiber; it would be extremely difficult in any case, and perhaps actually impossible.

It would be of great interest, to say the least, to study the effect of imparting to viscose rayons an artificial cuticle, if it could be done successfully; and it would be of particularly great interest to note, in the case of such a new fiber, how it would behave in comparison with the natural fiber; i.e., whether giving the iodine test in a cross-section, or as to its swelling-phenomena in copper-oxide-ammonia or ethylene-diamine. By mere precipitation, for example, of copper ferrocyanide, even if the substance of the layer were a matter of indifference, a homogeneous layer could not be formed; examination under the microscope always shows a deposition, very fine-grained indeed, but granular and not continuous. The natural cuticle, that of natural cotton, consists of an incorporation, into a continuous layer,

of various layers, of various organic substances, of aliphatic nature. Now, work has been done in recent years in this general direction; cotton itself, once cleansed of the layer of "foreign" matter, has been treated with such chemical agents as modify chemically the fiber (on the surface at least), with the particular purpose of altering its affinity toward certain groups of dyestuffs; and the farther this process goes, the more valuable the fiber becomes, provided the physical characteristics of the fiber are not affected unfavorably (immunized cotton, for example).

But such methods do not attain the same net result. Dyeing tests followed by microscopic study of cross-sections show that one process alters the fiber through and through; another method is more restrained, modifying the surface of the fiber, but its action also penetrates more or less deeply into the fiber; that is, no method at present known confines itself to producing a "cuticle," though in some cases an approach is made to this limited (and to be limited) result. Such treated fibers, however, when subjected to the action of swelling agents, for example, copper-oxide-ammonia, or -ethylene-diamine, display decided differences from what one gets with the natural cotton fiber; the characteristic swellings occur only here and there, or not at all; the degree of swelling as a whole is greatly reduced. The trouble seems to be, that the artificial cuticle is rather only a modification, physical and chemical, of the interior substance, and perhaps in chemical nature more closely allied to the pure endo-cellulose than is commonly supposed; and is therefore more easily penetrable, beside, itself, also undergoing some definite reaction of its own with the swelling agent, a reaction more or less allied with that undergone by the endo-cellulose.

The author mentions, in the closing part of this section, some experimental work upon cuprosilk coated with acetyl-cellulose and with benzyl-cellulose.

Two photomicrographs illustrate this section. The article is to be continued.

Contributions to the Theory of Acid Wool Dyeing (First Communication)

Dr. Ender and Dr. A. Mueller—Mell. Textil-Ber. 18, 633 (1937).—A valuable paper, from the Dyeing Section of the I.G. laboratories.

A brief review of various papers already published upon the topic is first given.

Wool, being an amphoteric substance, and therefore capable of being dyed with either basic or acid dyestuffs, the process from each side has been studied from various angles in times past; but, as the use of basic dyestuffs upon wool seems to be held in less and less esteem, owing to less satisfactory results with the basics, the problems involved in dyeing wool with acid colors seems to have been attracting more and more attention of late years. As far back as 1904 Knecht, and afterward Meyer and Fikentscher, established the fact that wool can neutralize an equivalent amount of an acid. The values found for this equivalent lie around 0.085 per 100 g. of wool (actually dry wool), and do not vary from this figure by more than about 5 per cent. Somewhat low values have been given for the equivalent by some authorities, but are probably due to the use of air-dried wool in the study. Samples of different origin, or wools which have been scoured by different methods, naturally give somewhat varying results; but in any case these deviations are not large, and can safely be ignored in a systematic study.

This fact, of wool possessing a definite absorptive power toward acids, naturally leads to the theory that acid dyeing of wool consists in a salt-formation between the dyestuff acid and the protein—in other words, it should be an actual chemical reaction, very different from the case of the dyeing of cotton with direct dyestuffs or with vat colors. The hypothesis that the taking up of acid by wool is an adsorptive process is contradicted by the fact that only the values of the dissociable hydrogen-atom of the acid has any influence upon the amount of acid taken up by the wool.

The present paper deals in a fundamental and exact way with the above aspect of the topic. Previous work has been done with dyestuffs themselves, which have been mostly certain acid wool dyestuffs not fast to water. And, usually, dyeings have been carried out, not with the free, pure dye-acid, but with acidified solutions of the dyestuffs (sodium salts), however pure the dyestuffs used might be, thereby working under complex conditions (presence of electrolytes, for example). This present work has been carried out with carefully purified dye-acids, not dyestuffs, so that the baths contained only wool, pure dye-acid, and water.

The authors prepared, or had prepared in their laboratories, carefully purified acids of eleven acid wool dyestuffs of various types. The best way of preparing them consisted in first precipitating the given dyestuff from solution carefully, by the now familiar method of dissolving and salting out with sodium acetate, then filtering, washing free of chlorides by saturated sodium acetate solution, drying, and extracting the sodium acetate by boiling alcohol. From such purified dyestuffs the free dye-acid was obtained by dissolving in hot water and adding the calculated amount of mineral acid, the amount of water being so adjusted that the dye-acid set free would remain in solution in the hot medium, crystallizing out as the solution cooled, the product thus being obtained in a purer state than by cold precipitation, with its certainty of carrying down some dyestuff or sodium chloride from the reaction. The products thus obtained were further purified by recrystallization from dilute hot mineral acid or from suitable organic solvents, the final material being so pure that upon ignition it left no ash.

The dye-acids chosen for the study were selected with a definite purpose; for example, from the eleven prepared, Orange II contained one sulfo group, Orange GG two, Crystal Ponceau two, Naphthol Red S three, Orange GG and Crystal Ponceau 6R involved a transition from the benzene to the naphthalene series, Orange II and Acid Anthracene Red G involved doubling of the molecule, etc.

In the study of the actual dyeing process and its extent,

the method of potentiometric determination of the amount of dye-acid left in the bath was considered the most accurate and least liable to impeachment by other factors, and was therefore used. Eight graphs and one table illustrate the results obtained. The table gives the acid equivalent for each of nine of the dye-acids; and it is interesting to note that the values lie between 0.081 and 0.095, most of them either at or close to 0.085.

The dye-acids studied went upon the fiber very slowly at the ordinary temperature, and several still slowly at 50° C., while mineral acids were taken up, even in the cold, rapidly. This would account for some discordant results in previously reported work, carried out according to the traditional method of dyeing from a dyebath containing the dyestuff itself, and mineral acid.

The Use of Naphthol AS in Acetate Silk Dyeing

Dr. R. Metzger and H. Roehling—Mell. Textil-Ber. 18, 644 (1937).—A paper of practical scope. Detailed directions and formulae are given in abundance, and swatches and card-skeins are included as specimens. As definitely named dyestuffs are cited and recommended, the article may perhaps be regarded as propaganda; but, after all, such things are unavoidable in a paper of practical nature; and this article should be of great value to a dyer struggling with this particular problem.

Dyeing of Rayon (Viscose) in the Mass

G. Lepage—Mell. Textil-Ber. 18, 647 (1937).—The production of the artificial fibers, as to furnishing a product which will definitely possess stably uniform properties, has been worked out, one may say, quite completely; but the problems and uncertainties involved in dyeing such fibers can not be said to have reached any great degree of certainty as yet; the problems of even and fast dyeing are still a matter of perplexity. It is natural, then, that efforts have been made for several years to devise some way of dyeing the fiber in the process of actual manufacture, to predye it, so to say, by incorporation of dyestuff or pigment, or suitable derivatives of them into the spinning mass itself, thus, as it were, dyeing the fiber before it is formed. Meister Lucius and Bruening, and Courtaulds, proposed to add to the viscose mass vat dyestuffs in the reduced state, the necessary oxidation to the color-pigment taking place during the washing of the fiber. This method, apparently so promising, has encountered so many practical difficulties that it has proved worthless, the chief difficulty being that the leuco-compounds show a strong tendency to crystallize out of the viscose mass before the spinning can take place, resulting in unevenness of deposition and distribution of the pigment in the fiber, and also in serious and troublesome contamination of the apparatus. It has also been proposed to add the vat dyestuff in the unreduced state, in a finely-divided condition, to the spinning mass, the viscose itself being expected to accomplish the necessary reduction; this method also has proved useless from the practical side. Courtaulds attempted to prevent the crystallization of the leuco-salt, above mentioned, by addition of various organic solvents to the spinning-mass. The I.G. proposed a further modification of the same idea, by adding the solid, finely-divided vat dyestuff to the spinning-mass, under such conditions that it would pass into the fiber as the latter formed, appearing in the spun fiber in microscopic granules, the yarn being then treated with alkali-hydrosulfite solution to reduce the pigment and allow the soluble leuco-compound to diffuse evenly in the fiber, stopping the process at the desired point (before the leuco-compound began to diffuse out of the fiber), by oxidizing the leuco-compound through treatment of the yarn in an oxidizing bath. The difficulties encountered in this method have proved almost if not quite insuperable.

Other classes of dyestuffs have of course been proposed for use. For example, substantive dyestuffs are fairly resistant toward the reductive influence of the spinning-mass, and the customary aftertreatments. But there are few substantive dyestuffs at all suitable in some respects—a comparatively small range of tones is available, and the fastness properties of the group are hardly good. Sulfur dyestuffs have been examined for the purpose; the difficulties which their employment presents are in general those inherent in the use of the Indanthrene vat-colors; and in addition their tones are not bright, nor are they fast to chlorine. Of course, the Naphthol AS series has been considered; but the process must consist in addition of the Naphthol to the spinning-mass, followed by treatment of the loaded fiber in an alkaline bath, followed by a passage through a diazo-salt bath to develop the color; and the Naphthol in the fiber will partly dissolve out in the alkaline bath necessary, thus producing unevenness of depth of tone in the finished product.

The one process which appears to have proved itself completely satisfactory is the so-called Dosne process, which consists in adding an Indigosol to the spinning-mass. No alteration of the spinning-mass characteristics is brought about by the addition, and the final step, consists merely in treating the yarn in an acid oxidizing bath. The finished product is colored uniformly, and remains perfectly transparent, the fiber thus retaining its luster, which adds greatly to the brilliance of the color-effect. Examination under the microscope does not show a granular deposition of pigment, no particles of pigment being visible; the aspect of the fiber is that of a homogeneous fiber possessing color. And, further, the fiber shows a higher breaking-strength, as compared to that of a fiber dyed in the usual way (from a bath), and so suffering some unavoidable damage from the process of dyeing.

Altogether, the new process seems to be a distinct advance far beyond any results yet attained in the dyeing of rayon.

Identification of Vat Dyestuffs Upon the Fiber

Dr. B. Ferrari—TIBA 15, 411 (1937).—According to a prefatory note in the form of a short appreciation by H. Tatu, this paper may be considered as an extension of the already well-known work of Herzog, published in 1933, and bringing Herzog's work up to date. Herzog

based his distinctions upon these tests: reaction of the dyed fiber with concentrated sulfuric acid, reduction of the dyeing with hydrosulfite, and acid tests upon the fiber after its treatment with hydrosulfite. Ferrari has, in the present work, added two further tests; one with nitric acid, and one with stannous chloride solution, as well as occasional use of some other reagents in particular cases. The present part of the paper consists of a very large table, classifying the response, to these reagents, of forty-one vat dyestuffs, or groups of these.

The second and the closing sections of the paper consist likewise of very full analytical tables, covering all available vat dyestuffs up to the present time.

With English and American synonyms added, this paper should be of very great value indeed for use in this country.

Reactions Involved in Silk-Weighting

Hans Joachim-Henk—Mell. Textil-Ber. 18, 451 (1937).—A short, but useful, study of the chemical reactions involved in the usual stannic chloride-phosphate-waterglass process of weighting silk. There is, of course, little new to and to such a long-established process, save in the matter of points of view; but the paper contains a careful systematization of the reactions known or believed to occur. Two interesting points are noted: that, under some conditions, the reaction between stannic hydroxide and sodium hydroxide, in a reversal of the process of hydrolysis, to form sodium meta-stannate, a reaction which takes place side by side with others, may under some circumstances give rise to tendering of the fiber (that is, an occasional tendering of the goods may sometimes be traced back to this particular reaction "going wrong"; and the danger inherent in allowing the waterglass bath to reach a temperature of over 55° C., this resulting in hydrolysis and deposition of salicylic acid upon the goods, as well as dangerous tendering of the fiber from the sodium hydroxide set free. The need of absolutely soft water for the waterglass stage is also emphasized, since, with hard water, difficultly soluble double calcium or magnesium silicates are formed and deposited upon the goods, producing spots which can be removed only by hydrofluoric acid. Even an inexperienced worker would hardly risk a silk fabric with this reagent.

Contribution to the Theory of Chloring of Wool in Wool-Printing

Dr. E. Justin-Mueller—Mell. Textil-Ber. 18, 452 (1937).—The author concludes that, by reasonable chloring of woolen weaves, the formation of a superficial layer of meta-keratin (the result of chloring in general), imparts new and desirable properties to the goods; greater resistance toward external influences (moisture, water, fulling), more luster, much greater affinity for aqueous or dyestuff baths (i.e. apparently better wetting-out properties), a firmer feel, and more sharply-defined outlines of pattern in printing.

Some Microscopical Methods for the Description of the Morphological and Histological Structure of Fibers

W. Schramek and J. Helm—Monats. f. Textil-Ind. 52, 317 (1937).—An article well written, and copiously and beautifully illustrated, well worth study by textile microscopists.

OPEN FORUM

Rules under which this department of the REPORTER is conducted are as follows:

1. Anyone who has a technical problem on which he would like advice may submit it to the Reporter and it will be published in the first available issue.

2. Any reader who feels that he has a solution of the problem may forward his reply to us and if we feel that the reply is suitable it will be published in a succeeding issue.

3. For each such reply published the Reporter will pay a minimum of $2.

4. In case there is more than one answer to the same question, the one covering the subject in the most complete and authentic manner will be published, or if two answers are sufficiently different both will be published. If two answers are considered equally good, the one first received will be given priority.

5. The Reporter will assume no responsibility whatsoever for the accuracy of the answers submitted—it is simply offering a vehicle for the public expression of its readers' opinions.

6. Both the questioner and answerer must send in his complete name and address. When requested we will publish only the initials or other identifying insignia.

45—At the present time there are sold in drug stores, department stores, etc., chemical preparations which are advertised as preventing runs, snags, breaks and spots in silk hosiery. I am very much interested in having complete information on these products—the chemicals used, the names of such products, the sources of articles that may have appeared on this subject in magazines or books, and where the chemicals used in such preparations may be purchased and at what price per pound.—**O.K.P.**

Answer—There may be several types of these preparations, but all of those which I have seen depend upon an old and familiar principle—the precipitation of an insoluble metallic soap within the fibers of the hosiery treated. To obtain this result most effectively, it is necessary to use two baths. In the first bath the hosiery is soaked in a solution of some soluble aluminum salt. Then without rinsing, and preferably after drying, the hosiery is given a thorough soaping in a mild soap bath, with a good suds and with a thorough working of the fabric in the bath. This will insure uniform results. After this the hose is carefully rinsed and dried.

To obtain a result such as mentioned above, any simple soluble aluminum salt (aluminum salts are not the only ones which might be used, but they give a metallic soap of good color and adhesion) may be used in the first bath. Plain Alum, or Aluminum Sul-

fate is all right, but Potash Alum (Patassium Aluminum Sulfate) seems to be preferred because it is more neutral and is thought to yield a more even precipitate. Many of the chemical preparations to which O. K. P. refers are merely one of these alums, usually Potash Alum. Often a little perfume is added to give added appeal. Or there may be a mix of about 2 parts Potash Alum and 1 part Dextrine (Soluble Starch) with perfume. The dextrine acts as a protective colloid and probably is of definite value, as the precipitation of the Alum Soap is slowed and scumming and curding prevented. Both Alum and Dextrine are available anywhere, at prices of around 5c pound.

The soap bath which follows the treatment with the Aluminum Salt is absolutely necessary to form the Aluminum Soap precipitate, and although it is not always so stated, is an integral part of the treatment. However, since any mild soap will do, and since it is merely listed as a "soaping-off" after the treatment with the run-preventing chemical, the buyer usually would not object to this second bath.

It is possible that some of the Paraffin Wax-Aluminum Acetate Emulsions, sold as water-proofing agents, would give the same results which O. K. P. is interested in, and could be applied in a single bath.

Incidentally, hosiery treated in the alum and soap baths is effectively splash-proofed and will not spot from showers or light rains. The aluminum soaps are highly water-repellant.

The aluminum or metallic soaps which are precipitated within the silk fibers in the treatment mentioned act similarly to the wax on the shoe-makers thread. It makes the fibers lie down and adhere in such a manner as to add considerably to their strength. Probably also there is a very thin surface film giving added protection to the hosiery, though the porosity of the stocking is seldom affected adversely.

It might be added that good old-fashioned soap, and not one of the new synthetic detergents, is necessary in the second bath. Most of these would be resistant to the aluminum salt and would tend to wash it out instead of precipitating the aluminum soap which is the desired result.—**A. S. K.**

Unanswered Questions

46—A discussion has arisen in our plant as to the actual physical causes of scroop on silk fibers. Is this effect visible under the microscope, and if not, what is the actual physical change between unscrooped and scrooped silk? Several theories have been evolved with regard to this, none of which seem to hold water, and I would appreciate it very much if some one could assist me in shedding some light on this subject.—**A.G.A.**

47—Please give remedy for skeins floating in vat dyeing of unmercerized cotton in machine, when 8 hour boil out has been given in a well designed box kier (pressure type kier not being available).—**W.S.G.**

CLASSIFIED

POSITION WANTED: Finishing plant chemist desires responsible position. Expert on vats, napthols and other cotton and rayon dyeing. All types of control work and testing. 26 years' experience on yarn and piece goods. Write Box No. 993, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED:—Ten years experience in dyestuff laboratory. Experienced with all types of colors and materials. Pratt graduate. Age 29; single. Write Box No. 129, American Dyestuff Reporter, 440 Fourth Ave., New York, New York.

FOR SALE: 7 Proctor & Schwartz boarding, drying and hosiery finishing machines, with finger motion—will sell one or all—latest models; 2 100-pound Smith-Drum, all Monel metal, hosiery dyeing machines; 1 250-pound Smith-Drum, all Monel metal hosiery dyeing machine; 1 400-pound Smith-Drum, all Monel metal hosiery degumming or dyeing machine. Write to Box 137, American Dyestuff Reporter, 440 Fourth Avenue, New York, N. Y.

POSITION WANTED:—Salesman of proven ability, 22, now employed, wants selling connection in textile field with rated concern. Good salary essential. Textile school graduate. Send complete information. Write Box No. 138, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

POSITION WANTED:—Hosiery Mill Assistant—Interested in securing a position that combines the fulfillment of customers' requirements and mill operation. Has had 10 years' experience in full fashioned hosiery manufacturing and is familiar with entire manufacturing procedure, dyehouse, finishing department and office. Dealings with employees, correspondence and direct contact with customers have always been pleasant and satisfactory. Write Box No. 139, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

COLORIST or DYESTUFF SALESMAN WANTED by a small but successful and expanding dyestuff manufacturing concern. An investment of $8,000.00 is required for which investor will receive pro rata share of underlying securities and an officership in the concern. An excellent opportunity for man with ambition to be in business for himself and also have his investment secured. Write Box No. 140, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.

SALESMEN WANTED:—Manufacturer of Textile Specialties, Sulphonated Oils and Dyestuffs, has opening for men with knowledge of the trade and good contacts. State salary or commission and experience. Territory, New York, New England, New Jersey, Penna. and South. Write Box No. 141, American Dyestuff Reporter, 440 Fourth Ave., New York, N. Y.